ENVIRONMENTAL STRATEGIES CORPORATION

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# 1997 INTERIM GROUNDWATER MONITORING REPORT

## BUCKEYE RECLAMATION LANDFILL
## BELMONT COUNTY, OHIO

**PREPARED**

**BY**

**ENVIRONMENTAL STRATEGIES CORPORATION**

**JANUARY 16, 1998**

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January 16 1998

Mary Tierney Remedial Project Manager
U S Environmental Protection Agency SR-6J
77 West Jackson Boulevard
Chicago Illinois 60604

**Re Buckeye Reclamation Landfill Site - 1997 Interim Groundwater Monitoring Report**

Dear Mary

The referenced report prepared by ESC is enclosed for agency review

In general the 1997 monitoring showed little or no organic contamination in the wells/piezometers sampled A few inorganic constituents were present in some of the wells/piezometers at concentrations that were equal to or greater than, their respective MCL's

Please call me at (412) 831-4528 with agency questions or comments on the report

Sincerely,

J G Gleich
Buckeye Reclamation Project
Coordinator

Enclosure
GG98 004

cc Mary Tierney (1 copy)
Peter Thompson (2 copies)
Harlan Huffman (1 copy)
Doug Evans (1 copy)

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## Executive Summary

The purpose of interim groundwater monitoring for the Buckeye Reclamation Landfill (BRL) was to collect annual water levels and groundwater quality samples from piezometers and monitoring wells installed in the southern toe area as part of the long term monitoring effort Groundwater quality samples and water level measurements were collected from the unconsolidated material horizon the Benwood Limestone Formation and the Redstone Limestone Formation during September 1997 Water quality samples were collected from four piezometers installed during the Supplemental Hydrogeologic Study (1992) and a piezometer installed during the Southern Toe Hydrogeologic Study (1996) screened in the unconsolidated material water-bearing horizon One monitoring well installed during the RI/FS (1987) investigation was sampled to obtain water quality data in the Benwood Limestone Formation Water quality samples were collected from three monitoring wells installed in the Redstone Limestone Formation during the Southern Toe Hydrogeologic Study (1996)

Water level data were used to determine groundwater elevations for the unconsolidated material and Redstone Limestone water-bearing horizons Groundwater flow in the unconsolidated material horizon at the southern toe converges toward seep L-4 Groundwater in the unconsolidated material located west of seep L-4 migrates eastward toward the former Kings Run valley Groundwater elevations in the Redstone Limestone monitoring wells indicate that groundwater in the Redstone Limestone at the southern toe of the BRL migrates toward the south-southeast A groundwater flow direction for the Benwood Limestone was not determined because only one monitoring well installed in this horizon was measured

The collected groundwater quality samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs) total and dissolved metals, alkalinity ammonia nitrogen chemical oxygen demand (COD) chloride, nitrate and nitrite-nitrogen sulfate total dissolved solids (TDS) pH specific conductance and turbidity in accordance with the U S Environmental Protection Agency (EPA) approved interim groundwater monitoring

Four groundwater quality samples were collected from piezometers completed in the unconsolidated material horizon at the southern toe of the BRL The laboratory data indicate that

no SVOCs or PAHs were detected above Maximum Contaminant Levels (MCLs) Estimated concentrations of carbon disulfide were reported in P-1B and P-22 and an estimated concentration of 2-hexanone was reported in P-1B Acetone was detected in P-4, above the quantitation limit of the analytical method, at an estimated concentration of 16 micrograms per liter (ug/l) However the reported acetone concentration in P-4 was attributed to blank contamination after completion of the quality assurance/quality control (QA\QC) review Four VOCs and bis(2 ethylhexyl)phthalate (B2EHP) were reported at estimated concentrations below their quantitation limits Three of the four VOCs were further qualified as probable blank contamination after completion of the QA/QC review

Arsenic, beryllium, lead and nickel concentrations were reported above applicable MCLs in three of the four groundwater quality samples collected from the unconsolidated material The beryllium concentrations in P-4 and P-22, and the lead concentrations in all three water quality samples were qualified after the QA/QC review as estimated concentrations Chromium in P-4 exceeds its MCL The reported thallium concentrations in P-2 and P-4 exceed its MCL However the reported thallium concentrations in P-2 and P-4 were qualified as estimated concentrations after QA/QC review Reported concentrations of iron, manganese, sulfate total dissolved solids (TDS) and turbidity in all four water quality samples collected from the unconsolidated material piezometers exceed secondary maximum contaminant levels (SMCLs)

The absence of organic analytes above quantitation limits indicates that the unconsolidated material water-bearing horizon at the southern toe is not affected by organic materials disposed of at the site Inorganic parameters analyzed suggest that landfill leachate may be marginally affecting the groundwater in this water-bearing horizon In addition several inorganic constituents indicate that the unconsolidated horizon is probably affected by acid mine drainage (AMD)

One groundwater quality sample and a duplicate water quality sample were collected from monitoring well MW-11B completed in the Benwood Limestone Formation The laboratory data indicate that no VOCs SVOCs, or PAHs were detected above MCLs Carbon disulfide was detected in the water quality samples at an estimated concentration below the quantitation limit Concentrations of methylene chloride and acetone were also reported in the samples but were qualified as probable blank contamination after completion of the QA/QC review Estimated concentrations of thallium in the Benwood Limestone water quality samples

exceed its MCL no other reported metal concentrations exceed MCLs Reported concentrations of iron manganese, sulfate, TDS, and turbidity in the water samples, exceed SMCLs Chloride concentrations suggest that landfill leachate may be marginally influencing water quality in the Benwood Limestone water-bearing horizon The concentrations of iron, sulfate, manganese, and TDS suggest that the groundwater in the Benwood Limestone may be affected by acid mine drainage

Three groundwater quality samples were collected from monitoring wells completed in the Redstone Limestone horizon at the southern toe of the BRL The laboratory data indicate that no VOCs PAHs or SVOCs were detected above MCLs Three VOCs were detected below quantitation limits and were qualified as probable blank contamination after completion of the QA/QC review B2EHP was detected below its quantitation limit and its MCL, in all three water quality samples collected from the Redstone Limestone wells Concentrations of lead in MW-17C and thallium in MW-15C exceed their respective MCLs However, after completion of the QA/QC review the lead and thallium concentrations were qualified as being estimated concentrations Iron manganese, sulfate, TDS and turbidity concentrations in all three of the water quality samples exceed their SMCLs Chloride concentrations suggest that landfill leachate may be marginally influencing water quality in the Redstone Limestone water bearing horizon The concentrations of sulfate manganese iron and TDS suggest that the groundwater in the Redstone Limestone may be affected by acid mine drainage

In conclusion, water quality data from piezometers and monitoring wells at the southern toe of the BRL indicate that landfill leachate may be marginally affecting water quality in the unconsolidated material Benwood Limestone and Redstone Limestone horizons Apparently, historical municipal and industrial waste disposal activities are not affecting groundwater in these three water-bearing horizons significantly Groundwater quality in the unconsolidated material west of seep L-4 the Benwood Limestone, and the Redstone Limestone horizons appears to be affected by acid mine drainage

## 1 0 Introduction

This report documents the results of the 1997 interim groundwater monitoring conducted at the Buckeye Reclamation Landfill (BRL) The work was conducted in accordance with the interim groundwater monitoring plan presented in the April 22, 1997 correspondence from George Gleich, BRL Project Coordinator to the U S Environmental Protection Agency (EPA) The interim groundwater monitoring plan was approved by the EPA and the Ohio EPA by letter dated April 23, 1997 The field activities were conducted in accordance with the scope of work presented in the June 10, 1997 proposal from Environmental Strategies Corporation (ESC) to George Gleich, and subsequently submitted to the EPA on June 12 1997 The EPA and Ohio EPA approved ESC's proposal by correspondence dated July 15 1997 The protocols used during the interim groundwater monitoring activities were the same as those in the EPA-approved RD Work Plan (October 15 1992) for the Supplemental Hydrogeologic Study which was completed by ESC during December 1992 A representative of the Army Corp of Engineers (ACOE) visited the site on September 23 1997 during the groundwater sampling activities

## 1 1 Scope and Purpose of Study

The purpose of the interim groundwater monitoring is to collect annual groundwater quality samples and measure groundwater levels from piezometers and monitoring wells installed in the vicinity of the southern toe at the BRL Groundwater quality samples and water levels were collected from piezometers P-1B P-2 P-4 and P-22 installed in the unconsolidated material monitoring well MW-11B completed in the Benwood Limestone and monitoring wells MW-15C, MW-16C and MW-17C installed in the Redstone Limestone In addition a water level measurement was collected for piezometer P-13 which was completed in the unconsolidated material east of Kings Run

The collected groundwater quality samples were analyzed for the constituents described on Table 2 of the EPA approved April 22 1997 Ground Water Monitoring Plan Summary (Appendix A) Water quality analyses were performed by Ceimic Corporation, an EPA Contract Laboratory Program (CLP) member Ceimic is also certified to perform Ohio sanitary landfill analyses

The water level data were used to construct groundwater contour maps and to determine groundwater flow directions in the unconsolidated material and the Redstone Limestone water-bearing horizons in the vicinity of the southern toe at the BRL

## 1 2 Interim Groundwater Monitoring

The results of the interim groundwater monitoring conducted during September 1997 are presented in this report in accordance with the approved scope of work ESC collected groundwater quality samples and measured water levels in five piezometers and three monitoring wells between September 22 and 24, 1997

This report provides a summary and evaluation of the hydrologic (i e water levels and groundwater flow directions) and analytical (i e groundwater quality) data collected during the 1997 interim groundwater monitoring activities Groundwater contour maps for the unconsolidated material and the Redstone Limestone, in the vicinity of the southern toe are presented based on water level data collected during September 1997

## 1 3 Site Location and Description

The BRL site is part of a 658-acre tract of land located off State Route 214 approximately 4 miles southeast of St Clairsville and 1 2 miles south of Interstate 70 in sections 20 and 21 (Township 6 North Range 3 West) Richland Township Belmont County Ohio (Figure 1-1) Interstate 470 is located just south of the landfill access roadway and approximately 3,000 feet north of the landfill area The BRL site is situated on the western side of the Kings Run drainage ravine, it is bordered by Kings Run to the east and Unnamed Run to the west Kings Run flows to the south and empties into Little McMahon Creek west of the village of Neffs, Ohio The BRL landfill extends approximately 3 700 feet north to south and is approximately 500 to 1 000 feet in width The BRL site occupies approximately 100 acres of the 658 acre tract of land

Property adjacent to the east and west is hilly and mostly forested West of the site and Unnamed Run is Ebbert Road Along this road are farms and farther west a surface mine operation To the south the land is forested along the steeper slopes and cleared for residential development along the local stream valleys and roadways There is additional farmland north and northeast of the BRL

The original topography of the valley of Kings Run and the ridge to the west has been altered by mine refuse disposal and landfill operations Underground mining activities occurred beneath portions of and adjacent to the 658-acre property until approximately 1940 Until about 1950, the site was a disposal area for mine refuse Mine refuse from the processed coal was disposed of on the ridge west of Kings Run and in the Kings Run drainage ravine The BRL area was licensed as a public solid waste landfill in 1971 by the Belmont County Health Department (BCHD) and was operated until April 1991 under the name of Buckeye Reclamation Landfill or the Belmont County Landfill The BRL is located on property owned by Ohio Resources Corporation As a public landfill, the facility accepted general trash, rubbish and nonhazardous waste from municipalities and villages in the local Belmont County area

The BRL also accepted industrial sludges and liquid wastes These wastes were received between 1976 and 1979 and deposited in or near the identified waste pit The waste pit was a small impoundment located in the northern section of the landfill area

In the early 1980's the U S EPA and Ohio EPA conducted preliminary investigations to determine whether potential risks were posed by the BRL to public health and environment The BRL site was placed on the National Priorities List (NPL) in October 1984 Since then numerous studies have been conducted to characterize site conditions

## 1 4 Remaining Sections of Report

The following sections of this 1997 Interim Groundwater Monitoring Report include 2 0 Hydrogeologic Methods 3 0 Hydrogeologic Investigation Results 4 0 Groundwater Sampling Procedures and Results 5 0 Conclusions and 6 0 References All tables figures and appendices are included with this report

## 2 0 Hydrogeologic Methods

Groundwater quality samples and water levels were collected from four piezometers (P-1B, P-2 P-4 and P-22) and four monitoring wells (MW-11B, MW-15C, MW-16C, and MW-17C) installed in the vicinity of the southern toe area A water level was also collected from one additional piezometer (P-13) located east of Kings Run The locations of the interim groundwater monitoring piezometers and monitoring wells are presented on Figure 2-1 The piezometers and monitoring wells from which water quality samples or water levels were collected were re-surveyed by a registered and licensed Ohio surveyor for vertical elevations during October 1997 The methods used to conduct the 1997 interim groundwater monitoring were the same as those used during the Supplemental Hydrogeologic Study (1992) the Additional Hydrogeologic Investigation (1993) and the Southern Toe Hydrogeologic Investigation (1996) as approved by the EPA

Piezometers P-1B, P-2, P-4, and P-13 were installed in the unconsolidated material by ESC during the 1992 Supplemental Hydrogeologic Study Monitoring wells MW-15C MW-16C and MW-17C were completed in the Redstone Limestone Formation by ESC during the Southern Toe Hydrogeologic Investigation (1996) ESC also installed piezometer P-22 in the unconsolidated material at the southern toe during the Southern Toe Hydrogeologic investigation The Benwood Limestone Formation monitoring well (MW-11B) was installed during the Remedial Investigation/Feasibility Study (RI/FS) hydrogeologic investigations

## 2 1 Decontamination Procedures and Investigation Derived Waste Handling

Rinsewater generated during the equipment decontamination process was collected in a 5-gallon bucket and transported to an onsite tank for temporary storage pending characterization and subsequent disposal All purge water removed from the piezometers and monitoring wells before collection of the groundwater quality samples was transported from the wellhead area and placed in the onsite storage tank All personal protective equipment (PPE) used during the interim groundwater monitoring field activities was placed in a metal drum and labeled The onsite water storage tank and the PPE drum remain onsite and are located near the waste pit area as in previous investigations

## 2 2 Groundwater Measurements

On September 22, 1997, water levels were measured in piezometers (P-1B P-2 P-4, P-13, and P-22) and monitoring wells (MW11-B, MW-15C, MW-16C, and MW-17C) in the vicinity of southern toe area The location of the piezometers and monitoring wells are presented on Figure 2-1 Pertinent monitoring well and piezometer construction data, such as reference elevations screened interval total depth and the monitoring interval are presented in Table 2-1

## 2 3 Surveying

The vertical elevations of the five piezometers and four monitoring wells sampled during the 1997 interim groundwater monitoring were re-surveyed by Jack A Hamilton & Associates Inc of Steubenville Ohio Elevations of the monitoring wells and piezometers were recorded for the northern side of the outer protective casing, the inner polyvinyl chloride (PVC) casing and ground level Vertical elevation data are presented in Table 2-1 The interim groundwater monitoring piezometers and monitoring wells were re-surveyed to determine whether the reference elevation (i e top of PVC casing) had been affected by settlement of the unconsolidated material after installation of the monitoring wells or piezometers

## 3 0 Hydrogeologic Investigation Results

### 3 1 Results of Groundwater Level Measurements

Water levels measured in the piezometers and monitoring wells on September 22 1997 are presented in Table 2-2 In general the 1997 measured groundwater levels declined in the unconsolidated material piezometers from groundwater levels measured on July 8 1996 Groundwater elevations in the Redstone Limestone increased from those measured in the monitoring wells on July 8 1996

### 3 2 Hydrogeology of Southern Toe Area

#### 3 2 1 Unconsolidated Material

Groundwater elevations recorded during the September 1997 interim groundwater monitoring for the unconsolidated material range from a minimum of 842 53 feet MSL in P 1B to a maximum of 946 06 feet in P-13 (Table 3-1) The inferred groundwater contours for the unconsolidated material based on the September 1997 data, are shown on Figure 3 1 The water level data indicate that groundwater flow through the unconsolidated material migrates toward the seep L-4 discharge point

#### 3 2 2 Benwood Limestone

The groundwater elevation recorded during September 1997 for the Benwood Limestone (MW-11B) was determined to be 916 27 feet MSL (Table 3-1) and is presented on Figure 3-2 Groundwater elevation contours for the Benwood Limestone Formation were not developed because only one groundwater elevation from the formation was collected during the interim groundwater monitoring activities

#### 3 2 3 Redstone Limestone

Groundwater elevations and top of PVC casing reference elevations and depth to water measurements from monitoring wells MW-15C MW-16C and MW-17C are presented in Table 3-1 Groundwater elevations recorded during September 1997 ranged from a minimum of 798 90 feet MSL in MW-17C to a maximum of 812 70 feet MSL in MW-15C The inferred groundwater elevation contours for the Redstone Limestone Formation in the vicinity of the southern toe, based on the September 1997 data are shown on Figure 3-3

Factors which may influence the direction of groundwater flow in the Redstone Limestone include the presence or absence of fractures bedding planes, fracture density, conduit porosity and hydraulic conductivity Because of these factors the direction of groundwater flow in any specific bedrock horizon may be locally different than that depicted on a groundwater contour map

## 4 0 Groundwater Sampling Procedures and Results

### 4 1 Sampling Location and Parameters

Groundwater quality samples from four piezometers and four monitoring wells were collected between September 22 and 24, 1997, in accordance with the EPA-approved interim groundwater monitoring plan

Before sampling was initiated at each piezometer or monitoring well ESC inspected the monitoring well or piezometer to be sampled and measured the depth to water and total depth with an electronic water level indicator The probe and the tape of the water level indicator were decontaminated with deionized water after each use Each piezometer or well was monitored when first opened with a photoionization detector (PID) equipped with an 11 7 eV lamp to measure for the presence of organic vapors No organic vapor concentrations above ambient background levels were detected from the monitoring wells or piezometers

The collected groundwater quality samples were analyzed using contract laboratory program (CLP) protocols U S EPA SW-846 methods and quality assurance/quality control (QA/QC) procedures The collected groundwater quality samples were analyzed by Ceimic for the constituents listed in Table 2 of Appendix A The constituent list includes volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs) and the semi-volatile compound (SVOC) bis-(2-ethylhexyl)phthalate (B2EHP) total and dissolved metals, and the inorganic parameters alkalinity, ammonia nitrogen, chemical oxygen demand (COD) chloride nitrate and nitrite nitrogen pH, specific conductance sulfate, total dissolved solids (TDS) and turbidity in accordance with Ohio EPA Solid Waste Regulations 3745-27-10 and regulatory agency requests The VOCs, PAHs and B2EHP constituents were analyzed by U S EPA CLP Statement of Work (SOW) for Organics, OLM01 9 The metals were analyzed by EPA CLP SOW for inorganics ILM03 0 The inorganic parameters were analyzed by EPA Methods SM 2320B 350 1 410 4, 9056, 9056, 9056, 150 1 120 1, 9056 160 1 and 180 1 respectively

Sample containers for VOCs, total and dissolved metals ammonia and COD were received from the laboratory with the appropriate preservative All sample coolers were maintained at 4 degrees C and transported to the analytical laboratory by an overnight delivery service In addition to the laboratory analysis listed above the groundwater samples were analyzed in the field for the following parameters

- temperature
- pH
- specific conductance
- turbidity
- total alkalinity

## 4 2 Sampling Procedures

After recording the depth to water and total depth of each monitoring well or piezometer the purge volume necessary to remove three well volumes was calculated All purge water was placed in plastic 5-gallon containers, transported from the wellhead and placed in the onsite temporary storage tank

The piezometers and monitoring wells were purged using dedicated PVC bailers New and unused nylon rope was attached to the bailer when purging and dedicated to either the piezometer or monitoring well for sample collection The volume of groundwater purged from each piezometer or monitoring well was recorded on groundwater monitoring data log forms Field measurements of temperature pH and specific conductance were recorded from the prepurge beginning midpoint and final volumes of the purge process to ensure that these parameters stabilized before groundwater quality samples were collected In addition turbidity and total alkalinity measurements were recorded from the final purge volume The field parameter measurements were recorded on groundwater monitoring data log forms and are included as Appendix B A Horiba U-10 water quality meter was used to measure pH temperature specific conductance and turbidity A Hach Model AL-AP MG-L alkalinity field test kit was used for determining the total alkalinity The field measurements collected from the final purge volume are presented in Table 4-1

After the monitoring well or piezometer was purged groundwater quality samples for laboratory analysis were collected with a new dedicated Teflon bailer VOC samples were collected within 2 hours of purging the monitoring well or piezometer in accordance with the agency approved RD Work Plan protocols Groundwater quality samples collected for total and dissolved metal analysis were filtered in the field using a Masterflex pump Teflon tubing and

0 45-micron filters The collected groundwater quality samples were packed in iced coolers and forwarded via overnight delivery to the analytical laboratory

## 4 3 Sampling Results

The analytical results for the groundwater quality samples collected during the 1997 interim groundwater monitoring are presented in Tables 4-2 4-3 and 4-4 by water-bearing horizon These tables summarize the results that were detected above the quantitation limit of the analytical method or estimated concentrations below the quantitation limits A separate table with results for all of the parameters analyzed and the detection limits for each constituent is presented in Appendix C The QA/QC report prepared after reviewing the analytical data is presented in Appendix D The raw analytical data provided by the laboratory are available upon request A discussion of the sampling results for each water-bearing unit is presented in the following sections

### 4 3 1 Unconsolidated Material

The analytical results for the groundwater quality samples collected from the four piezometers screened in the unconsolidated water-bearing horizon are presented in Table 4 2 No VOCs were detected in the groundwater quality samples collected from the unconsolidated material piezometers above quantitation limits of the analytical method with the exception of acetone in P-4 The reported concentration of acetone was further qualified as probable blank contamination after completion of the QA/QC review

No PAHs were detected above the quantitation limit of the analytical method in the four water quality samples collected from the unconsolidated material water-bearing horizon

Total arsenic barium, beryllium, calcium chromium, cobalt copper iron magnesium manganese nickel potassium thallium vanadium and zinc were detected above the quantitation limit of the analytical methods in the groundwater quality samples

Dissolved antimony, arsenic, beryllium, cadmium cobalt, copper, iron, lead, magnesium, manganese nickel potassium, silver, sodium, thallium, vanadium, and zinc were detected above the quantitation limit of the analytical methods in the groundwater quality samples

Of the other inorganic parameters analyzed ammonia nitrogen concentrations ranged from 0 11 mg/l in P-2 to 3 99 mg/l in P-22, chloride was detected in all four water samples

ranging from 23 3 mg/l in P-22 to 217 mg/l in P-4, sulfate concentrations ranged from 1 320 mg/l in P-2 to 3,860 mg/l in P-1B, and reported pH values for the unconsolidated material water quality samples ranged from 3 47 in P-1B to 6 41 in P-4

The reported sulfate iron manganese, TDS, and turbidity concentrations in all four water quality samples collected from the unconsolidated material piezometers exceed SMCL's

Field measurements were recorded during the interim groundwater monitoring sampling event for pH temperature specific conductance, total alkalinity and turbidity These results are presented in Table 4-1

4 3 1 1 Evaluation of the Unconsolidated Material Sampling Results

Groundwater sampling results are provided in Table 4-2 Constituents in the unconsolidated material water-bearing horizon that exceed MCLs are presented on Figure 4-1

- Two VOCs (methylene chloride and acetone) were detected at or above the quantitation limit of the analytical methods and both VOCs were qualified as probable blank contamination
- Three VOCs (carbon disulfide, 2-butanone and 2-hexanone) were detected below the quantitation limit of the analytical methods and one (2-butanone) was qualified as probable blank contamination
- No VOCs were detected above MCLs
- One SVOC B2EHP was detected at estimated concentrations of 1 ug/l (P-4) and 3ug/l (P-1B) which is below its MCL of 6 ug/l B2EHP is a common laboratory contaminant
- No PAHs were detected
- The groundwater quality samples collected from the unconsolidated water-bearing horizon indicate no apparent impacts from VOCs SVOCs or PAHs
- Total arsenic beryllium lead and nickel in piezometers P-1B P-4 and P-22 exceed MCLs Chromium and thallium concentrations in P 4 and thallium levels in P-2 exceed MCLs
- No other metal constituents were above MCLs in the unconsolidated material water quality samples
- Iron and manganese concentrations in all four piezometers exceed their respective secondary maximum contaminant levels (SMCL) of 0 3 mg/l and 0 05 mg/l

- Chloride in P-4 was near the SMCL of 250 mg/l which indicates that solid waste disposal may be affecting the water quality at this location

- The low chloride concentrations in piezometers P-1B, P-2, and P-22 suggest that these areas may be marginally affected by landfill leachate

- The sulfate and TDS concentrations in all four unconsolidated material piezometers exceed their respective SMCLs of 250 mg/l and 500 mg/l respectively

- Nondetectable concentrations of alkalinity, low pH values, and elevated iron, manganese sulfate and TDS concentrations suggest that P-1B and P-22 are being affected by acid mine drainage (AMD)

- The SMCL for turbidity (1 0 NTU) was exceeded in every piezometer sampled during the 1997 interim groundwater monitoring activities

- The general absence of organic analytes above quantitation limits suggests that the southern toe area of the BRL is not affected by organic materials disposed of in the former waste pit area

4 3 2 Benwood Limestone

The analytical results for the one groundwater monitoring well installed in the Benwood Limestone Formation (MW-11B) sampled during the 1997 interim groundwater monitoring are presented in Table 4-3 Groundwater quality sample MW-60 was a duplicate sample collected from MW-11B for QA/QC protocols

No VOCs were detected above the quantitation limit in the groundwater quality sample (MW-11B) or the duplicate sample (MW-60) collected from the Benwood Limestone monitoring well The estimated concentrations of methylene chloride and acetone were further qualified as probable blank contamination after completion of the QA/QC review

No SVOCs were detected in the two water quality samples collected from the Benwood Limestone horizon above the quantitation limit of the analytical methods

Total antimony barium beryllium cadmium calcium cobalt iron lead magnesium manganese nickel potassium silver sodium thallium and zinc were detected above the quantitation limits of the analytical methods in the groundwater quality samples

The reported estimated concentrations of thallium in MW-11B (3 8 ug/l) and the duplicate MW-60 (3 7 ug/l) exceed the MCL for thallium The MCL for thallium is 0 002 mg/l (2 ug/l) The reported concentrations of iron and manganese collected from the MW-11B

monitoring well exceed SMCLs The SMCLs for these metals are iron 0 3 mg/l (300 ug/l) and manganese 0 05 mg/l (50 ug/l

Dissolved barium, calcium, cobalt, copper, iron, lead, magnesium, manganese nickel, potassium, sodium, thallium, vanadium, and zinc were detected above the quantitation limit of the analytical methods in the groundwater quality samples collected from the Benwood Limestone

Of the other inorganic parameters analyzed ammonia nitrogen concentrations ranged from 0 39 mg/l to 0 45 mg/l chloride concentrations ranged from 71 3 mg/l to 74 3 mg/l sulfate ranged from 977 mg/l to 980 mg/l, and reported pH values for the samples were 6 67 and 6 76 in MW-11B and MW-60 respectively

The reported concentrations of sulfate (977 mg/l) and TDS (1,840 mg/l) in MW-11B and the sulfate (980 mg/l) and TDS (1 870 mg/l) concentrations in MW-60 exceed SMCLs The SMCLs for sulfate and TDS are 250 mg/l and 500 mg/l respectively The Benwood Limestone water quality samples exceed the turbidity SMCL of 1 NTU

Field measurements were recorded during the groundwater quality sampling event for pH, temperature specific conductance total alkalinity and turbidity These results are presented in Table 4-1

4 3 2 1 Evaluation of the Benwood Limestone Sampling Results

Groundwater sampling results are provided in Table 4-3 Constituents in the Benwood Limestone water-bearing horizon that exceed MCLs are presented on Figure 4-2

- No VOCs were detected above the quantitation limit of the analytical method
- Three VOCs (methylene chloride acetone and carbon disulfide) were detected below the quantitation limit and the first two were qualified as probable blank contamination
- No VOCs were detected above MCLs
- No SVOCs or PAHs were detected in the two water quality samples
- The groundwater in the Benwood Limestone has at this location apparently not been affected by VOCs, SVOCs or PAHs
- Estimated concentrations of thallium in MW-11B and the duplicate sample (MW-60) exceed the MCL

- No other metal constituents were above MCLs in the Benwood Limestone water quality samples
- Iron and manganese concentrations in the Benwood Limestone water quality samples exceed SMCLs
- Nitrate and nitrite nitrogen concentrations were reported as not detected in the water quality samples and suggests that this area is not affected by landfill leachate
- The low chloride concentration in monitoring well MW-11B suggests that this area may be marginally affected by landfill leachate
- The reported sulfate and TDS concentrations in the water quality samples exceed SMCLs
- The SMCL for turbidity (1 0 NTU) was exceeded in the water samples collected from the MW-11B monitoring well
- The absence of organic analytes above quantitation limits suggests that this area of the BRL site is not affected by organic materials disposed of in the waste pit
- The reported iron manganese, sulfate, TDS and alkalinity concentrations suggest that this carbonate aquifer, in the vicinity of the MW-11B monitoring well, may be marginally affected by acid mine drainage

4 3 3 Redstone Limestone

The analytical results for the three groundwater monitoring wells installed in the Redstone Limestone Formation (MW-15C MW-16C, and MW-17C) which were sampled during the 1997 interim groundwater monitoring activities are presented in Table 4-4

No VOCs were detected in the three Redstone Limestone water quality samples above the quantitation limit of the analytical methods Methylene chloride acetone and 2-Butanone were detected in the water quality samples below quantitation limits of the analytical methods but were qualified as probable blank contamination after completion of the QA/QC review

No PAHs were detected in the groundwater quality samples collected from the Redstone Limestone water-bearing horizon above the quantitation limit of the analytical methods

Concentrations of total arsenic, barium, beryllium, cadmium calcium chromium cobalt copper iron, magnesium manganese nickel potassium selenium silver sodium thallium

vanadium, and zinc were detected above the quantitation limit of the analytical methods in the collected groundwater quality samples

Total antimony, barium, beryllium, cadmium, chromium, cobalt, lead silver, sodium, thallium and zinc were detected in the three Redstone Limestone water quality samples at estimated concentrations above the quantitation limit or were qualified as estimated after completion of the QA/QC review

The estimated concentration of lead (74 ug/l) in MW-17C and the estimated thallium concentrations in MW 16C (2 ug/l) and MW-17C (3 3 ug/l) equal or exceed their respective MCLs The reported concentration of iron and manganese in all three water quality samples collected from the Redstone Limestone monitoring wells exceed SMCLs

Dissolved cadmium, iron manganese, potassium, and sodium were detected above the quantitation limit of the analytical methods in the Redstone Limestone water quality samples

Of the other inorganic parameters nitrate-nitrogen was detected in one (MW-17C) of the three Redstone Limestone water quality samples at a concentration of 2 08 mg/l, ammonia nitrogen concentrations ranged from 1 63 mg/l to 2 47 mg/l, COD was detected in MW-16C and MW-17C at concentrations of 30 mg/l and 1 330 mg/l respectively chloride concentrations were detected in all three samples ranging from 68 9 mg/l to 120 mg/l sulfate was detected at concentrations ranging from 1 400 mg/l to 2 850 mg/l TDS concentrations ranged from 2,480 mg/l to 4 420 mg/l reported pH values ranged from 6 3 to 7 22, and turbidity ranged from 80 5 NTUs to 1,240 NTUs

The reported sulfate and TDS concentrations in all three water quality samples collected from the Redstone Limestone monitoring wells exceed SMCLs

4 3 3 1 Evaluation of the Redstone Limestone Sampling Results

Groundwater sampling results are provided in Table 4-4 Constituents that exceed MCLs detected in the Redstone Limestone water quality samples are presented on Figure 4-3

- No VOCs were detected above the quantitation limit of the analytical methods
- Four VOCs (methylene chloride, acetone, 2-butanone, and 2-hexanone) were detected below the quantitation limit three of these were qualified as probable blank contamination
- No VOCs were detected above MCLs

- No PAHs were detected above the quantitation limit of the analytical methods
- One SVOC (B2EHP) was detected in the water quality samples at estimated concentrations ranging from 2 ug/l to 4 ug/l, which are below the MCL of 6 ug/l
- No other SVOCs or PAHs were detected above MCLs
- Groundwater in the Redstone Limestone water-bearing horizon in the vicinity of the southern toe has apparently not been affected by VOCs SVOCs or PAHs
- The estimated concentration of lead (74 ug/l) in MW-17C and the estimated concentrations of thallium in MW-17C (3 3 ug/l) and MW-16C (2 ug/l) equal or exceed MCLs
- Iron and manganese concentrations in all three Redstone Limestone monitoring wells exceed SMCLs
- No other metal constituents were detected above MCLs or SMCLs in the Redstone Limestone water quality samples
- The low chloride concentrations in monitoring wells MW-15C MW 16C and MW-17C suggest that these areas may be marginally affected by landfill leachate
- Alkalinity concentrations and pH values in the water quality sample collected from the three monitoring wells suggests that the Redstone Limestone is buffered by the carbonate bedrock
- Sulfate and TDS concentrations exceed SMCLs in all three groundwater quality samples
- The absence of organic analytes above quantitation limits suggests that the Redstone Limestone in the vicinity of the southern toe has not been affected by organic materials disposed of in the waste pit
- Sulfate, iron, manganese and TDS concentrations suggest that the Redstone Limestone monitoring wells may be influenced by acid mine drainage

## 4 4 Quality Assurance/Quality Control

### 4 4 1 Chemical Analyses and Quality Assurance Protocols

Chemical analyses of groundwater samples collected during the 1997 interim groundwater monitoring were performed using CLP and other EPA-approved methods and protocols included in SW-846 (3rd Edition) or other EPA manuals or promulgated regulations The groundwater quality samples were collected and analyzed in accordance with the Quality Assurance Project Plan (QAPP) Revision 2 as approved by the U S EPA on November 25, 1992 with respect to the RD Work Plan and the Supplemental Hydrogeologic Study

Ten percent of all samples collected during the field activities for laboratory analyses were duplicated During the 1997 interim groundwater monitoring sampling event one duplicate groundwater quality sample (MW-60) was collected from monitoring well MW-11B Water quality sample MW-60 was submitted blind to the laboratory Internal laboratory duplicates were also analyzed at the rate of 1 per every 10 samples submitted for analysis

The accuracy of analytical techniques and instrument calibration was monitored through the use of calibration standards Quality control (QC) checks including the analysis of one field blank and a trip blank provided with each batch of sample containers to the laboratory, were used to ascertain the integrity of analyses Methylene chloride acetone, and 2-butanone which are common laboratory contaminants were detected in the field blank and the trip blanks Therefore these analytes were qualified as attributable to probable blank contamination in the data tables These qualifications did not affect the overall quality or assessment of the analytical data

Sample matrices were examined to evaluate their effect on the analytical protocol One matrix spike/matrix spike duplicate (MS/MSD) sample was analyzed in conjunction with the 1997 interim groundwater monitoring The MS/MSD sample was analyzed for CLP parameters only (Level IV sample) Matrix spike recoveries laboratory duplicate precision, and ICP serial dilutions were outside QC limits for several reported metals This resulted in qualifying the appropriate metals results as estimated concentrations in the data tables However, these qualifications did not affect the overall quality or assessment of the analytical data

Laboratory QC reference samples were integrated into the analytical scheme to assess accuracy All field and laboratory QC samples were analyzed according to the method protocols as regular samples including all spikes dilutions and processing All QC samples were evaluated based on the CLP or other EPA accepted criteria of the relevant analytical level

4 4 2 Data Validation

All samples obtained and analyzed were subjected to data validation using the QA/QC criteria specified in the EPA's guidance documents for data validation or the specific analytical method Data validation was accomplished by Ceimic Corporation's Quality Assurance (QA) Officer and the QA Officer of ESC All laboratory data were validated by ESC's QA Officer using original laboratory reports Ceimic produced data reports that allowed for validation by including all CLP deliverables or QA/QC deliverables for the relevant analytical method Appropriate equations for precision accuracy (bias) and completeness were used for all analyses The data reporting packages were reviewed thoroughly by ESC s QA Officer

The data validation process involved a review of instrument calibration procedures instrument tuning and performance holding times blanks MS/MSD interference in analytical determinations compound identification system performance verifying calculations and data assessment Criteria for accepting and rejecting data was based on EPA s Functional Guidelines for the Evaluation of Organic and Inorganic Analysis (EPA, 1988) or the QA/QC criteria for the relevant analytical method

A preliminary review was performed by ESC to verify that all necessary paperwork (chain of custody s traffic reports analytical reports laboratory personnel signatures) and deliverables were present A detailed QA review was performed by ESC to verify the qualitative and quantitative reliability of the data as they were presented This review included a detailed review and interpretation of all data generated by Ceimic

Based on the review of the analytical data an organic and inorganic QA report was prepared and is provided in Appendix D The report consists of a general introduction section followed by qualifying statements that were taken into consideration for the analytical results used in the tables Based on the QA review, qualifier codes were placed next to specific sample results on the sample data tables These qualifier codes serve as an indication of the qualitative and quantitative reliability of the data A glossary of data qualifiers is also included

Based on the QA/QC review, detected VOCs and metals were qualified as probable blank contamination or estimated concentrations The analytical data as qualified, are of acceptable quality and are usable for the purpose of assessing the potential groundwater contamination at the BRL site

## 5 0 Conclusions

This section summarizes the key results of the 1997 interim groundwater monitoring completed during September 1997 at the BRL site

### 5 1 Groundwater Flow Directions

One goal of the interim groundwater monitoring was to measure water levels in the unconsolidated material water-bearing horizon the Benwood Limestone Formation and Redstone Limestone Formation for determining and evaluating groundwater flow directions To accomplish this groundwater elevations were measured in five unconsolidated material piezometers one monitoring well installed in the Benwood Limestone and three monitoring wells installed in the Redstone Limestone Based on the groundwater elevation data collected during September 1997 groundwater contour maps for the unconsolidated material and the Redstone Limestone were constructed A groundwater contour map for the Benwood Limestone could not be constructed because only one measurement location was included in the interim groundwater monitoring

Based on the September 1997 water levels measured in the unconsolidated material piezometers groundwater in the unconsolidated material at the southern toe of the BRL site converges toward the seep L-4 discharge Groundwater in the unconsolidated material west of seep L-4 flows southeast towards the former Kings Run valley

Groundwater flow in the Redstone Limestone Formation is toward the south-southeast based on the 1997 data from the three monitoring wells The groundwater flow direction is further supported by the known dip of the bedrock to the southeast

### 5 2 Groundwater Quality of Unconsolidated Material Horizon

Groundwater quality samples were collected from four piezometers completed in the unconsolidated material at the southern toe of the BRL Based on the analytical data no VOCs PAHs SVOCs with the exception of B2EHP were detected in the water quality samples above MCLs B2EHP is a common laboratory contaminant Arsenic beryllium and nickel concentrations in P-1B, arsenic chromium and nickel concentrations in P-4, and arsenic and nickel concentrations in P-22 exceed applicable MCLs The reported concentrations of iron,

manganese, sulfate, TDS, and turbidity in all four sampled unconsolidated material piezometers exceed applicable SMCLs Low chloride concentrations suggest that the unconsolidated water-bearing horizon at the southern toe may be marginally affected by landfill leachate Nondetectable alkalinity concentrations and elevated iron, sulfate, and manganese results indicate that groundwater in the unconsolidated material west of seep L-4 may be affected by acid mine drainage The absence of organic analytes above quantitation limits suggests that organic materials disposed of in the waste pit area are not migrating offsite through the unconsolidated material at the southern toe of the BRL

## 5 3 Groundwater Quality of the Benwood Limestone

One groundwater quality sample and a duplicate water quality sample were collected from the MW-11B Benwood Limestone monitoring well, this well was installed along the eastern margin of the BRL site during the RI/FS investigation

Based on the analytical data no VOCs PAHs SVOCs or metals were detected in the water quality samples above MCLs Thallium concentrations in the two water samples exceed the applicable MCL of 0 002 mg/l however these reported concentrations were qualified as estimated concentrations after completion of the QA/QC review Concentrations of iron manganese sulfate TDS and turbidity exceed applicable SMCLs in both Benwood Limestone water quality samples Low chloride concentrations suggest that this area is only marginally affected by landfill leachate Low iron sulfate and manganese concentrations suggest that this area is only marginally affected by acid mine drainage The absence of organic analytes above quantitation limits suggests that organic materials disposed of in the waste pit area are not migrating offsite through the Benwood Limestone aquifer in this general area of the BRL

## 5 4 Groundwater Quality of the Redstone Limestone

Three water quality samples were collected from the Redstone Limestone monitoring wells installed across the southern toe and analyzed for the constituents listed in the approved interim groundwater monitoring plan These Redstone Limestone monitoring wells were installed at the southern toe during the 1996 southern toe investigation

Based on the analytical data, no VOCs, PAHs, or SVOCs were detected in the water quality samples above MCLs Methylene chloride acetone and 2-butanone were detected below

their quantitation limits and were attributed to blank contamination B2EHP was the only SVOC detected in all three water quality samples, and it was at estimated concentrations below its MCL, B2EHP is a common laboratory contaminant Concentrations of lead in MW-17C and thallium in MW-16C exceed applicable MCLs, however, both reported concentrations were qualified as estimated concentrations after completion of the QA/QC review Reported concentrations of iron, manganese, sulfate TDS, and turbidity in all three sampled Redstone Limestone monitoring wells exceed SMCLs Low chloride concentrations in the groundwater monitoring wells indicate that the Redstone Limestone horizon at the southern toe of the BRL may be marginally affected by landfill leachate Concentrations of iron sulfate manganese and TDS suggest that the Redstone Limestone Formation may be affected by acid mine drainage The absence of organic analytes above quantitation limits suggests that organic materials disposed of in the waste pit area are not migrating offsite and that the Redstone Limestone horizon has not been adversely affected by the landfill activities

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Tables

**Table 2-1**

**Construction Data for Piezometers and Monitoring Wells**
**Interim Groundwater Monitoring**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**

| Monitoring Well/ Piezometer | Surface Elevation (ft/MSL) | Top of Casing Elevation (ft/MSL) | Total Depth (ft)(a) | Monitoring Interval (ft)(b) | Well Diameter (in ) |
|---|---|---|---|---|---|
| **Unconsolidated** | | | | | |
| P 1B | 850 6 | 853 02 | 29 31 | 24 5 26 5 | 2 |
| P 2 | 852 0 | 853 11 | 15 13 | 11 0 13 0 | 2 |
| P 4 | 873 7 | 875 61 | 25 30 | 13 0 23 0 | 2 |
| P 13 | 961 0 | 963 21 | 19 42 | 13 0 18 0 | 2 |
| P 22 | 861 2 | 863 54 | 32 00 | 19 0 21 5 | 2 |
| **Benwood Limestone** | | | | | |
| MW 11B | 936 6 | 937 90 | 34 40 | 17 0 32 0 | 2 |
| **Redstone Limestone** | | | | | |
| MW 15C | 852 0 | 854 61 | 54 30 | 29 0 52 0 | 2 |
| MW 16C | 851 4 | 853 66 | 49 40 | 34 8 46 5 | 2 |
| MW 17C | 860 5 | 863 30 | 67 66 | 47 0 65 5 | 2 |

a/ Measured from top of PVC casing
b/ Measured from ground surface

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**Table 3 1**

**Water Table Elevations for Piezometers and Monitoring Wells**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22, 1997 (a)**

| Well/ Piezometer | Top of PVC Casing Elevation | Depth to Water (ft) (b) | Water Table Elevation |
|---|---|---|---|
| **Unconsolidated Material** | | | |
| P 1B | 853 02 | 10 49 | 842 53 |
| P 2 | 853 11 | 3 63 | 849 48 |
| P 4 | 875 61 | 11 84 | 863 77 |
| P 13 | 963 21 | 14 15 | 949 06 |
| P 22 | 863 54 | 17 25 | 846 29 |
| **Benwood Limestone** | | | |
| MW 11B | 937 90 | 21 63 | 916 27 |
| **Redstone Limestone** | | | |
| MW 15C | 854 61 | 41 91 | 812 70 |
| MW 16C | 853 66 | 41 20 | 812 46 |
| MW 17C | 863 30 | 64 40 | 798 90 |

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a/ All elevations in feet above mean sea level
b/ Top of PVC casing

**Table 4 1**

**Final Field Measurements**
**Piezometers and Monitoring Wells**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22-24, 1997**

| Well/Piezometer | Temperature (°C) | Specific Conductivity (ms/cm) | pH | Turbidity (NTU) | Total Alkalinity (mg/l) |
|---|---|---|---|---|---|
| **Unconsolidated** | | | | | |
| P 1B | 12 4 | 3 82 | 3 72 | 390 | <20 |
| P 2 | 13 8 | 2 71 | 6 26 | 490 | 820 |
| P 4 | 14 6 | 3 37 | 5 87 | >1 000 | >1 000 |
| P 22 | 14 0 | 3 72 | 4 62 | 999 | 40 |
| **Benwood Limestone** | | | | | |
| MW 11B | 13 7 | 2 08 | 7 23 | 53 | 440 |
| **Redstone Limestone** | | | | | |
| MW 15C | 13 7 | 3 80 | 6 22 | 504 | 620 |
| MW 16C | 14 6 | 3 90 | 5 82 | 91 | 740 |
| MW 17C | 14 0 | 3 07 | 6 74 | 97 | 760 |

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**Table 4 2**

**Groundwater Sampling Results Unconsolidated Material**
**Buckeye Reclamation Landfill**
**Belmont County Ohio (ug/l)(a)**
**September 22 24 1997**

| Compound | P 1B | P 2 | P-4 | P 22 | MCLs (b) | SMCLs (c) |
|---|---|---|---|---|---|---|
| **VOCs** | | | | | | |
| Methylene Chloride | 5 BJ | 4 BJ | 4 BJ | 3 BJ | 5 | |
| Acetone | 5 BJ | 3 BJ | 16 BJ | 5 BJ | | |
| Carbon Disulfide | 1 J | 5 U | 5 U | 1 J | | |
| 2 Butanone | 2 BJ | 10 U | 10 U | 10 U | | |
| 2 Hexanone | 1 J | 10 U | 10 U | 10 U | | |
| **SVOCs** | | | | | | |
| Bis(2-ethylhexyl)phthalate | 3 J | 10 U | 1 J | 10 U | 6 | |
| **Total Metals (ug/l)** | | | | | | |
| Antimony | 1 7 UJ | 1 7 UJ | 1 8 UJ | 2 8 J | 6 | |
| Arsenic | 65 6 | 3 2 U | 143 | 74 5 | 50 | |
| Barium | 37 6 J | 28 8 J | 979 | 141 J | 2 000 | |
| Beryllium | 9 3 | 0 3 U | 4 7 J | 4 5 J | 4 | |
| Cadmium | 2 U | 0 49 U | 1 3 J | 2 U | 5 | |
| Calcium | 377000 | 382000 | 616000 | 378000 | | |
| Chromium | 19 6 | 6 5 U | 121 | 40 9 | 100 | |
| Cobalt | 88 6 | 7 U | 611 | 65 4 | | |
| Copper | 10 7 J | 3 8 U | 168 | 143 | | 1 000 |
| Iron | 595000 | 1590 | 157000 | 819000 | | 300 |
| Lead | 21 3 J | 4 4 J | 102 J | 146 J | 15 | |
| Magnesium | 59400 | 112000 | 172000 | 79400 | | |
| Manganese | 2630 | 724 | 7380 | 3850 | | 50 |
| Nickel | 370 | 10 7 J | 1070 | 203 | 100 | |
| Potassium | 16700 | 1240 J | 24200 | 16200 | | |
| Silver | 3 6 J | 1 1 U | 1 6 J | 5 5 J | | 100 |
| Sodium | 122000 J | 124000 J | 221000 J | 106000 J | | |
| Thallium | 1 5 U | 3 5 J | 12 7 | 1 5 U | 2 | |
| Vanadium | 57 3 | 5 3 U | 108 | 40 5 J | | |
| Zinc | 1560 | 17 9 J | 697 | 847 | | 500 |
| **Dissolved Metals (ug/l)** | | | | | | |
| Antimony | 3 J | 1 7 U | 1 7 U | 3 3 J | | |
| Arsenic | 52 8 | 3 2 U | 26 8 | 47 7 | | |
| Barium | 12 1 J | 20 8 J | 19 7 J | 48 U | | |
| Beryllium | 8 6 | 1 7 J | 0 3 U | 6 U | | |
| Cadmium | 8 U | 0 64 J | 0 4 U | 8 U | | |
| Calcium | 348000 J | 352000 J | 445000 J | 426000 J | | |
| Chromium | 18 3 J | 19 4 J | 6 5 UJ | 130 UJ | | |
| Cobalt | 84 5 | 7 U | 14 7 J | 140 U | | |
| Copper | 4 8 J | 3 8 U | 3 8 U | 76 U | | |
| Iron | 546000 | 63 3 J | 21400 | 644000 | | |
| Lead | 20 1 J | 2 5 J | 4 3 J | 25 2 J | | |
| Magnesium | 55600 J | 99700 J | 151000 J | 87800 J | | |
| Manganese | 2470 | 472 | 5920 | 4280 | | |
| Nickel | 354 | 9 9 J | 71 | 193 J | | |
| Potassium | 15000 | 1350 J | 3110 J | 12700 | | |
| Silver | 3 5 J | 1 1 U | 1 1 U | 5 5 J | | |
| Sodium | 114000 | 114000 | 240000 | 120000 | | |
| Thallium | 8 9 J | 1 5 U | 3 5 J | 3 4 J | | |
| Vanadium | 61 3 | 5 3 U | 5 3 U | 106 U | | |
| Zinc | 1490 | 8 J | 12 J | 1500 | | |
| **Other Analytical Parameters (mg/l)** | | | | | | |
| Alkalinity | 2 U | 696 | 1080 | 2 U | | |
| Ammonia nitrogen | 3 71 | 0 11 | 1 1 | 3 99 | | |
| Chemical oxygen demand | 111 | 15 6 | 850 | 25 | | |
| Chloride | 85 8 | 92 3 | 217 | 23 3 | | 250 000 |
| Nitrate nitrogen | 0 1 U | 0 1 | 0 11 | 0 1 U | 10 000 | |
| Nitrite nitrogen | 0 1 U | 0 1 | 0 1 U | 0 067 J | 1 000 | |
| pH (units) | 3 47 | 6 23 | 6 41 | 4 6 | | 6 5 8 5 |
| Specific Conductance (umhos/cm) | 4150 | 2750 | 3680 | 3910 | | |
| Sulfate | 3860 | 1320 | 1670 | 3400 | 500 000 | 250 000 |
| Total dissolved solids | 5400 | 2360 | 3480 | 4370 | | 500 000 |
| Turbidity (NTU) | 46 | 99 | 4600 | 2300 | | 1 |

a/ U=undetected J=estimated concentration B=probable blank contamination
MCL = Maximum Contaminant Level SMCL = Secondary Maximum Contaminant Level
b/ MCLs based on EPA October 1996 standards
c/ SMCLs based on EPA October 1996 standards

**Table 4-3**

**Groundwater Sampling Results, Benwood Limestone**
**Buckeye Reclamation Landfill**
**Belmont County Ohio (ug/l)(a)**
**September 22 24 1997**

| Compound | MW 11B | MW-60 (b) | MCLs | SMCLs |
|---|---|---|---|---|
| **VOCs** | | | | |
| Methylene Chloride | 4 BJ | 5 B | 5 | |
| Acetone | 4 BJ | 3 BJ | | |
| Carbon Disulfide | 2 J | 2 J | | |
| **Total Metals (ug/l)** | | | | |
| Antimony | 2 7 J | 1 7 UJ | 6 | |
| Barium | 21 3 J | 15 6 J | 2 000 | |
| Beryllium | 0 72 J | 0 3 U | 4 | |
| Cadmium | 0 54 J | 0 57 J | 5 | |
| Calcium | 321000 | 319000 | | |
| Cobalt | 11 8 J | 16 3 J | | |
| Iron | 2020 | 2090 | | 300 |
| Lead | 1 5 J | 3 2 J | 15 | |
| Magnesium | 73800 | 71900 | | |
| Manganese | 897 | 893 | | 50 |
| Nickel | 21 5 J | 24 7 J | 100 | |
| Potassium | 5980 | 4770 J | | |
| Silver | 1 6 J | 1 2 J | | 100 |
| Sodium | 74700 J | 72000 J | | |
| Thallium | 3 8 J | 3 7 J | 2 | |
| Zinc | 14 7 J | 10 4 J | | 500 |
| **Dissolved Metals (ug/l)** | | | | |
| Barium | 9 2 B | 10 5 J | | |
| Calcium | 283000 J | 302000 J | | |
| Chromium | 6 5 UJ | 6 5 UJ | | |
| Cobalt | 11 J | 18 J | | |
| Copper | 5 9 J | 18 7 J | | |
| Iron | 2800 | 1430 | | |
| Lead | 1 3 UJ | 1 3 J | | |
| Magnesium | 65300 J | 68100 J | | |
| Manganese | 677 | 713 | | |
| Nickel | 14 5 J | 28 5 U | | |
| Potassium | 4000 J | 3910 U | | |
| Sodium | 66700 | 69100 | | |
| Thallium | 1 9 U | 1 7 J | | |
| Vanadium | 5 3 U | 12 9 J | | |
| Zinc | 9 2 J | 16 2 J | | |
| **Other Analytical Parameters (mg/l)** | | | | |
| Alkalinity | 402 | 406 | | |
| Ammonia nitrogen | 0 45 | 0 39 | | |
| Chemical oxygen demand | 5 U | 7 2 | | |
| Chloride | 71 3 | 74 3 | | 250 000 |
| pH (units) | 6 67 | 6 76 | | 6 5 8 5 |
| Specific Conductance (umhos/cm) | 2060 | 2060 | | |
| Sulfate | 977 | 980 | 500 000 | 250 000 |
| Total dissolved solids | 1840 | 1870 | | 500 000 |
| Turbidity (NTU) | 23 | 18 2 | | 1 |

a/ U=undetected J=estimated concentration B=probable blank contamination
MCL = Maximum Contaminant Level SMCL = Secondary Maximum Contaminant Level
b/ Duplicate of MW 1B

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**Table 4-4**

**Groundwater Sampling Results, Redstone Limestone**
**Buckeye Reclamation Landfill**
**Belmont County Ohio (ug/l)(a)**
**September 22 24 1997**

| Compound | MW 15C | MW 16C | MW 17C | MCLs (b) | SMCLs (c) |
|---|---|---|---|---|---|
| **VOCs** | | | | | |
| Methylene Chloride | 4 BJ | 5 BJ | 4 BJ | 5 | |
| Acetone | 2 BJ | 3 BJ | 2 BJ | | |
| 2 Butanone | 1 BJ | 10 U | 1 BJ | | |
| 2 Hexanone | 10 U | 10 U | 1 J | | |
| **SVOCs** | | | | | |
| Bis(2-ethylhexyl)phthalate | 2 J | 4 J | 3 J | 6 | |
| **Total Metals** | | | | | |
| Antimony | 1 7 UJ | 1 7 UJ | 1 7 UJ | 6 | |
| Arsenic | 3 2 U | 3 2 U | 26 7 | 50 | |
| Barium | 45 8 J | 31 6 J | 623 | 2 000 | |
| Beryllium | 0 87 J | 0 3 U | 1 9 J | 4 | |
| Cadmium | 0 51 J | 0 4 U | 2 4 J | 5 | |
| Calcium | 378000 | 444000 | 75700 | | |
| Chromium | 7 6 J | 6 5 U | 43 4 | 100 | |
| Cobalt | 7 U | 12 7 J | 14 3 J | | |
| Copper | 3 8 U | 3 8 U | 43 8 | | 1 000 |
| Iron | 10900 | 9500 | 22800 | | 300 |
| Lead | 3 5 J | 1 3 UJ | 74 J | 15 | |
| Magnesium | 234000 | 257000 | 27500 | | |
| Manganese | 331 | 290 | 185 | | 50 |
| Nickel | 7 9 U | 41 6 | 52 9 | 100 | |
| Potassium | 7810 | 7400 | 10900 | | |
| Selenium | 3 3 U | 3 3 U | 16 9 | 50 | |
| Silver | 1 6 J | 1 1 U | 3 8 | | 100 |
| Sodium | 288000 J | 232000 J | 610000 J | | |
| Thallium | 1 9 J | 2 J | 3 3 J | 2 | |
| Vanadium | 5 3 U | 5 3 U | 62 4 | | |
| Zinc | 12 6 J | 20 7 | 65 8 | | 500 |
| **Dissolved Metals** | | | | | |
| Antimony | 1 9 J | 1 7 U | 1 7 U | | |
| Barium | 7 6 J | 11 9 J | 18 3 J | | |
| Beryllium | 0 43 J | 0 43 J | 0 3 U | | |
| Cadmium | 0 4 U | 0 4 U | 5 7 | | |
| Calcium | 343000 J | 436000 J | 64700 J | | |
| Chromium | 6 5 UJ | 6 5 J | 6 5 UJ | | |
| Copper | 9 1 J | 3 8 U | 5 8 J | | |
| Iron | 8630 | 3650 J | 101 | | |
| Lead | 1 3 J | 1 3 J | 69 5 J | | |
| Magnesium | 207000 J | 256000 J | 21600 J | | |
| Manganese | 321 | 265 | 78 2 | | |
| Nickel | 8 3 J | 32 2 J | 7 9 U | | |
| Potassium | 6260 | 7030 | 3720 J | | |
| Silver | 1 1 U | 1 1 U | 2 7 J | | |
| Sodium | 261000 | 231000 | 738000 | | |
| Thallium | 2 1 J | 2 1 J | 1 5 U | | |
| Vanadium | 7 4 J | 5 3 U | 5 3 U | | |
| Zinc | 10 J | 14 5 J | 12 3 J | | |
| **Other Analytical Parameters (mg/l)** | | | | | |
| Alkalinity | 698 | 776 | 868 | | |
| Ammonia nitrogen | 1 98 | 1 63 | 2 47 | | |
| Chemical oxygen demand | 5 U | 30 | 1330 | | |
| Chloride | 108 | 120 | 68 9 | | 250 000 |
| Nitrate nitrogen | 0 1 U | 0 1 U | 2 08 | 1 000 | |
| pH (units) | 6 3 | 6 37 | 7 22 | | 6 5 8 5 |
| Specific Conductance (umhos/cm) | 4080 | 4260 | 3820 | | |
| Sulfate | 2470 | 2850 | 1400 | 500 000 | 250 000 |
| Total dissolved solids | 4110 | 4420 | 2480 | | 500 000 |
| Turbidity (NTU) | 80 5 | 86 | 1240 | | 1 |

a/ U=undetected J=estimated concentration B=probable blank contamination
MCLs = Maximum Contaminant Level SMCLs = Secondary Maximum Contaminant Level
b/ MCLs based on EPA October 1996 standards
c/ SMCLs based on EPA October 1996 standards

Figures

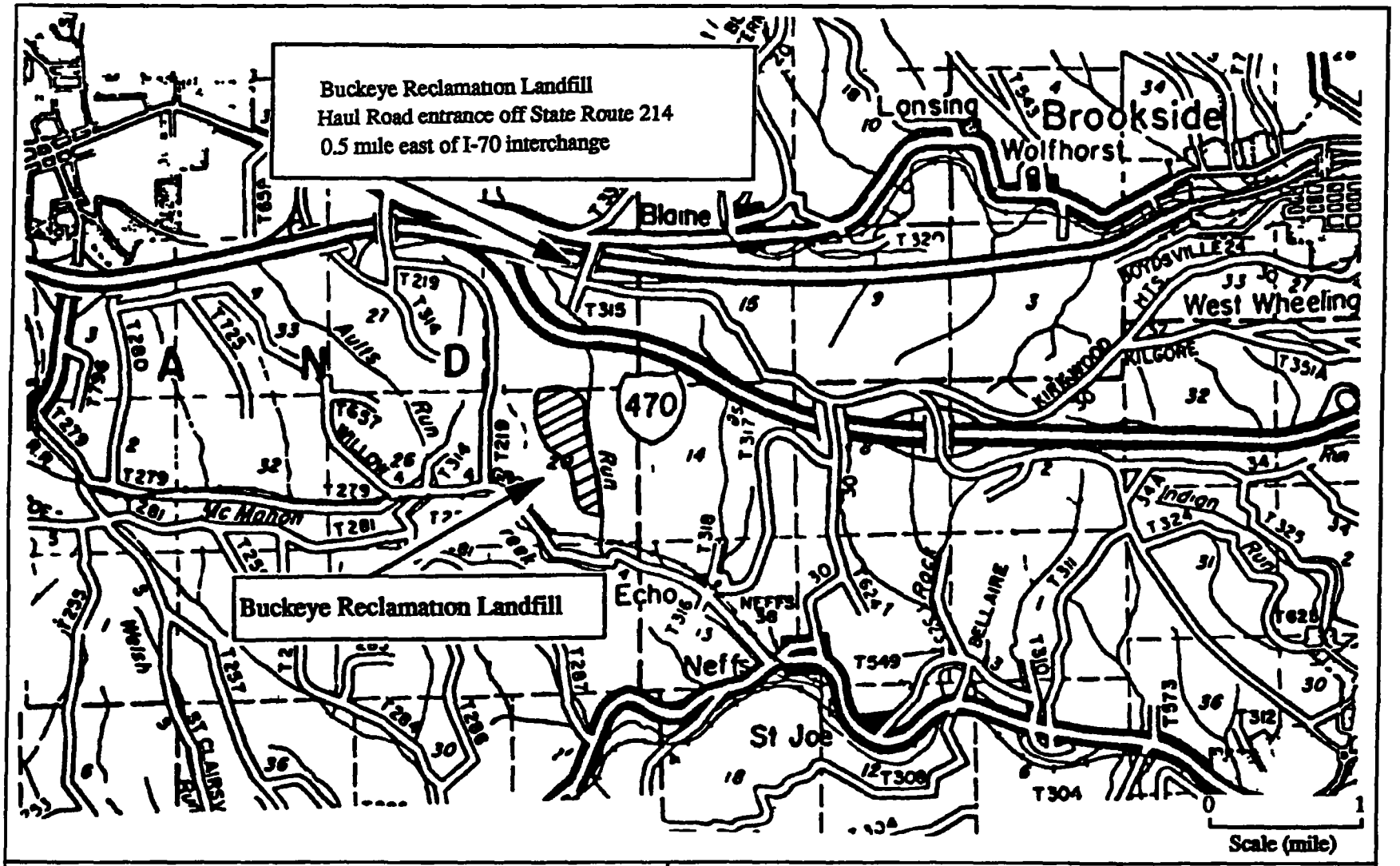


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Figure 1-1

Site Location
Buckeye Reclamation Landfill Site
Belmont County Ohio

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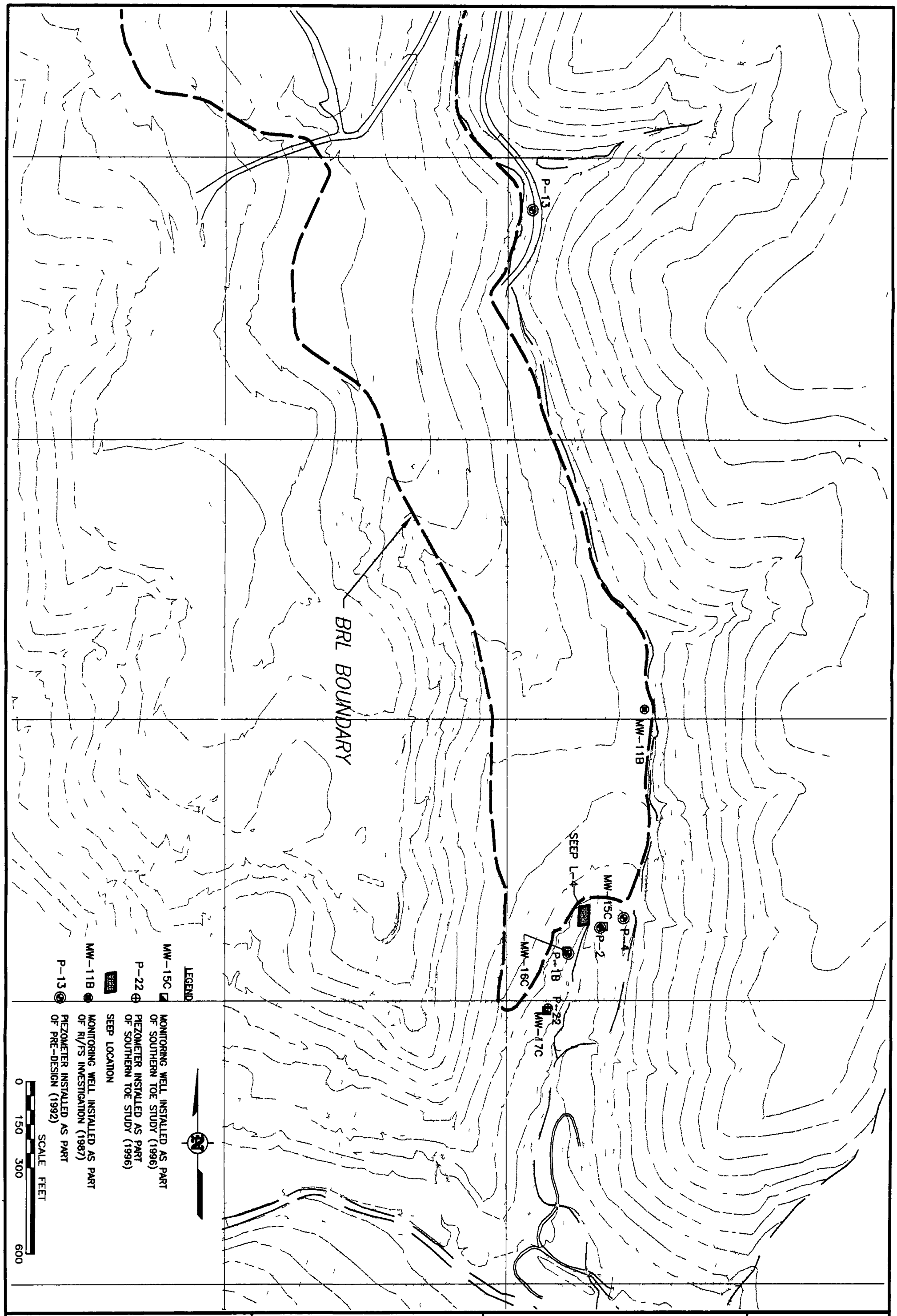



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Figure 2-1

LOCATION OF INTERIM GROUNDWATER MONITORING PIEZOMETERS AND MONITORING WELLS

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By TMB 12/19/97
Checked.
Approved
Drawing Number 144195-B1

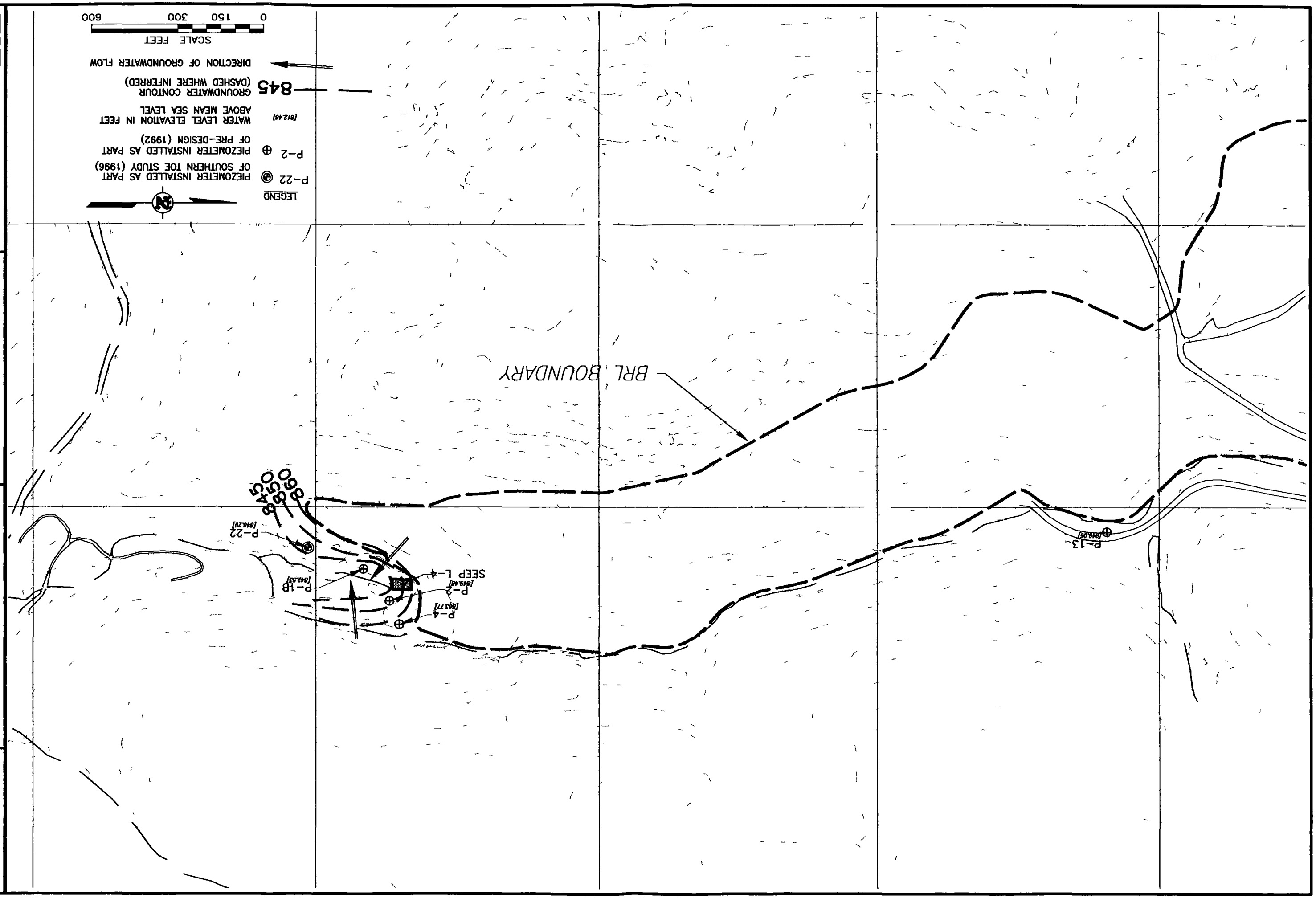


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Figure 3-1

GROUNDWATER CONTOUR MAP
UNCONSOLIDATED MATERIAL
SEPTEMBER 1997

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By: TMB 12/19/97
Checked:
Approved:
Drawing Number: 144195-B4

RAZ D \DWG\ 14\ 144195\ B02 dwg 01 14 1998 10 29a

BRL BOUNDARY

MW-11B (91.27)

LEGEND

MW-11B (91.27) MONITORING WELL INSTALLED AS PART OF RI/FS INVESTIGATION (1987)
WATER TABLE ELEVATION IN FEET ABOVE MEAN SEA LEVEL

SCALE FEET
0 150 300 600

**ENVIRONMENTAL STRATEGIES CORPORATION**
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Pittsburgh Pennsylvania 15276
(412) 787-5100

Figure 3-2

WATER TABLE ELEVATION
BENWOOD LIMESTONE SEPTEMBER 1997

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By TMB 12/19/97
Checked.
Approved
Drawing Number 144195-B2

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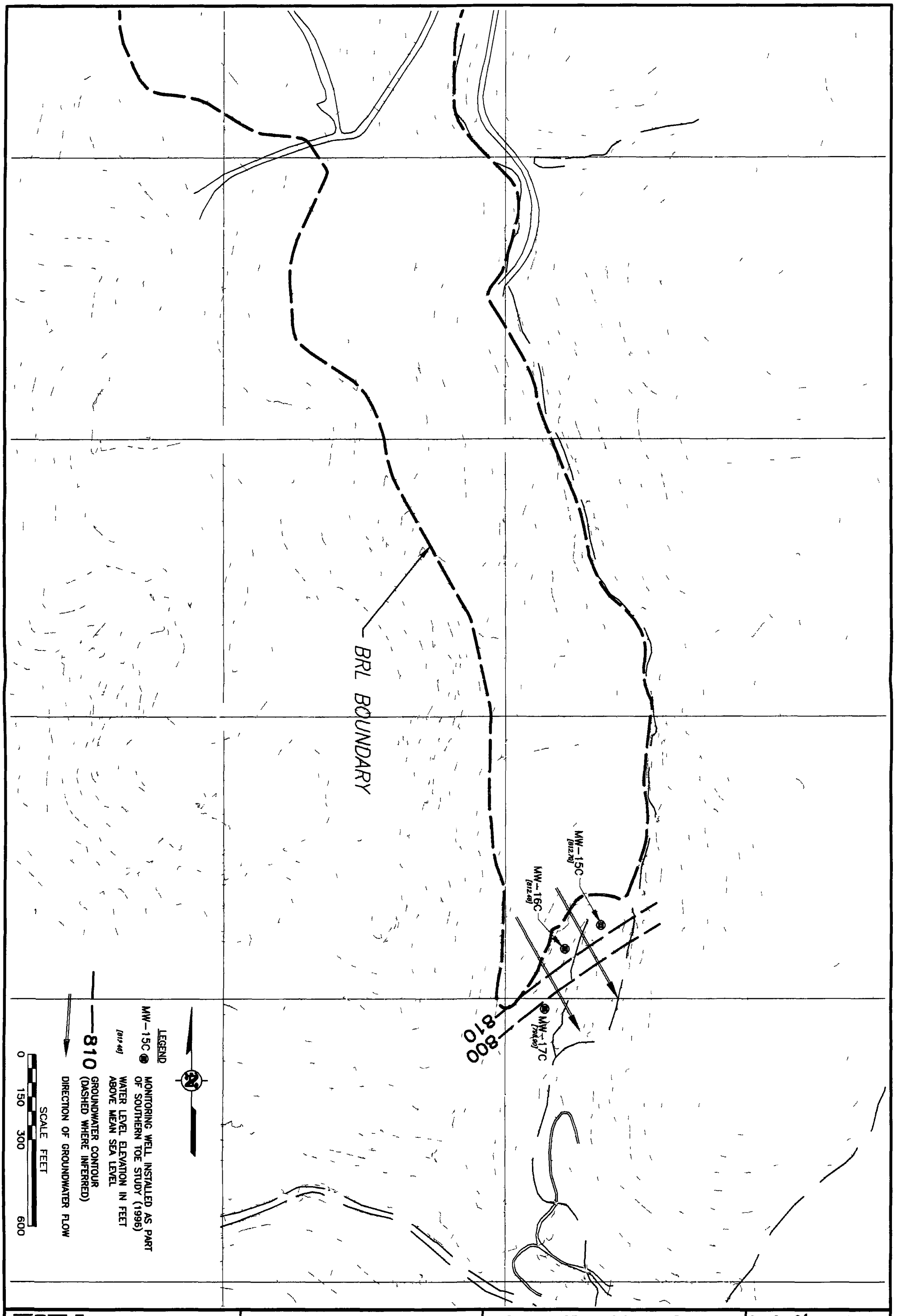


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Figure 3-3

GROUNDWATER CONTOUR MAP
REDSTONE LIMESTONE SEPTEMBER 1997

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By RAZ 112397
Checked
Approved
Drawing Number 464313-B3

RAZ D \DWG\14\144195\ B05 dwg 01 14 1998 10 31a

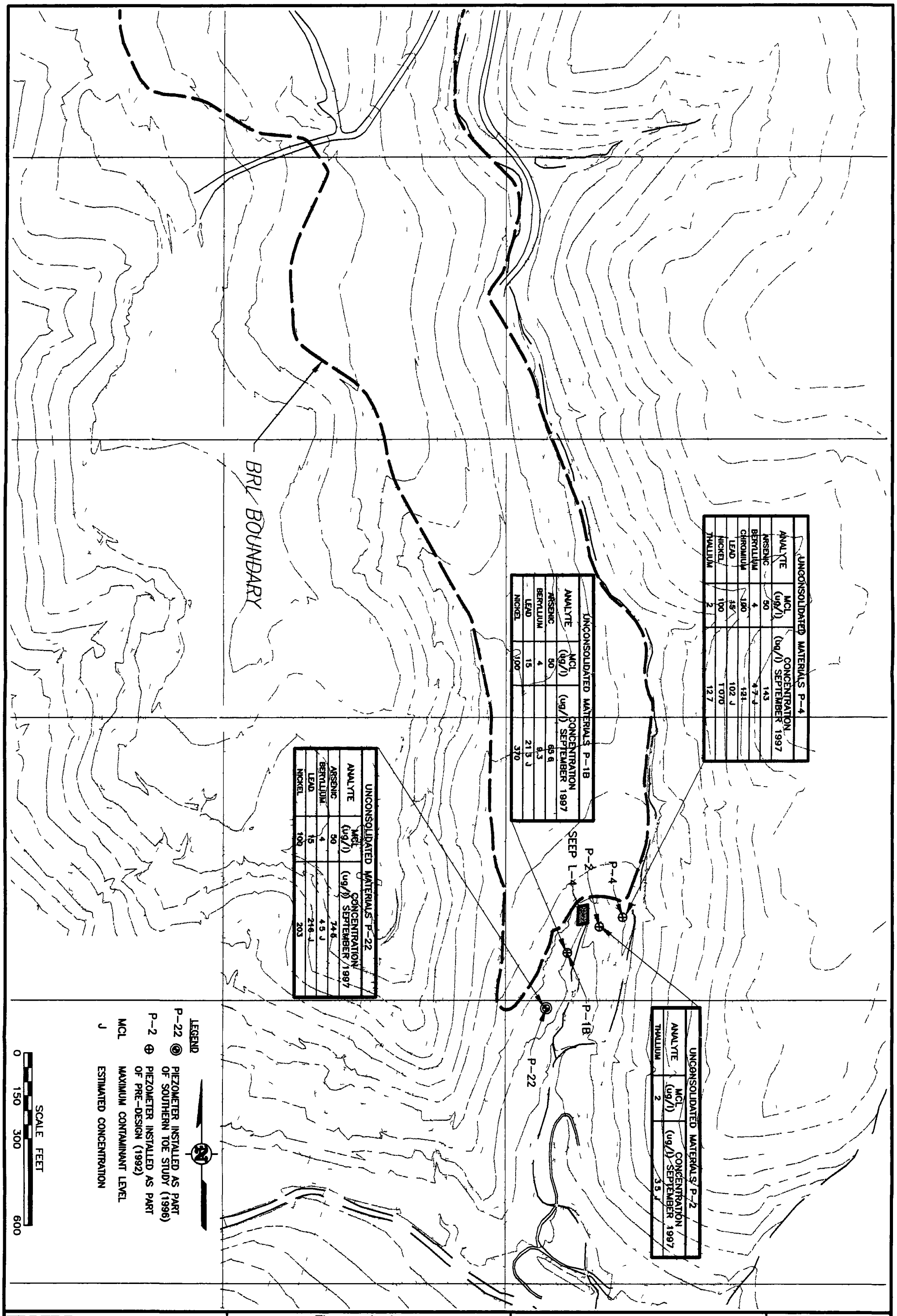


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Figure 4-1
GROUNDWATER SAMPLING LOCATIONS WHERE ANALYTE CONCENTRATIONS EXCEED THE MAXIMUM CONTAMINANT LEVEL (MCL) UNCONSOLIDATED MATERIALS SEPTEMBER 1997

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By TMB 12/19/97
Checked
Approved
Drawing Number 144195-B5

MW-11B

| BENWOOD LIMESTONE, MW-11B | | |
|---|---|---|
| ANALYTE | MCL (ug/l) | CONCENTRATION (ug/l) SEPTEMBER 1997 |
| THALLIUM | 2 | 38 |

BRL BOUNDARY

LEGEND

MW-11B ⊕ MONITORING WELL INSTALLED AS PART OF RI/FS INVESTIGATION (1987)

MCL MAXIMUM CONTAMINANT LEVEL

SCALE FEET

0 150 300 600

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO

PREPARED FOR

BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By TMB 12/19/97

Checked

Approved

Drawing Number 144195-B6

Figure 4-2

GROUNDWATER SAMPLING LOCATION WHERE ANALYTE CONCENTRATION EXCEEDS THE MAXIMUM CONTAMINANT LEVEL (MCL) BENWOOD LIMESTONE, SEPTEMBER 1997

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L:\144195\Drawings\ 12-30-1997 2:15p

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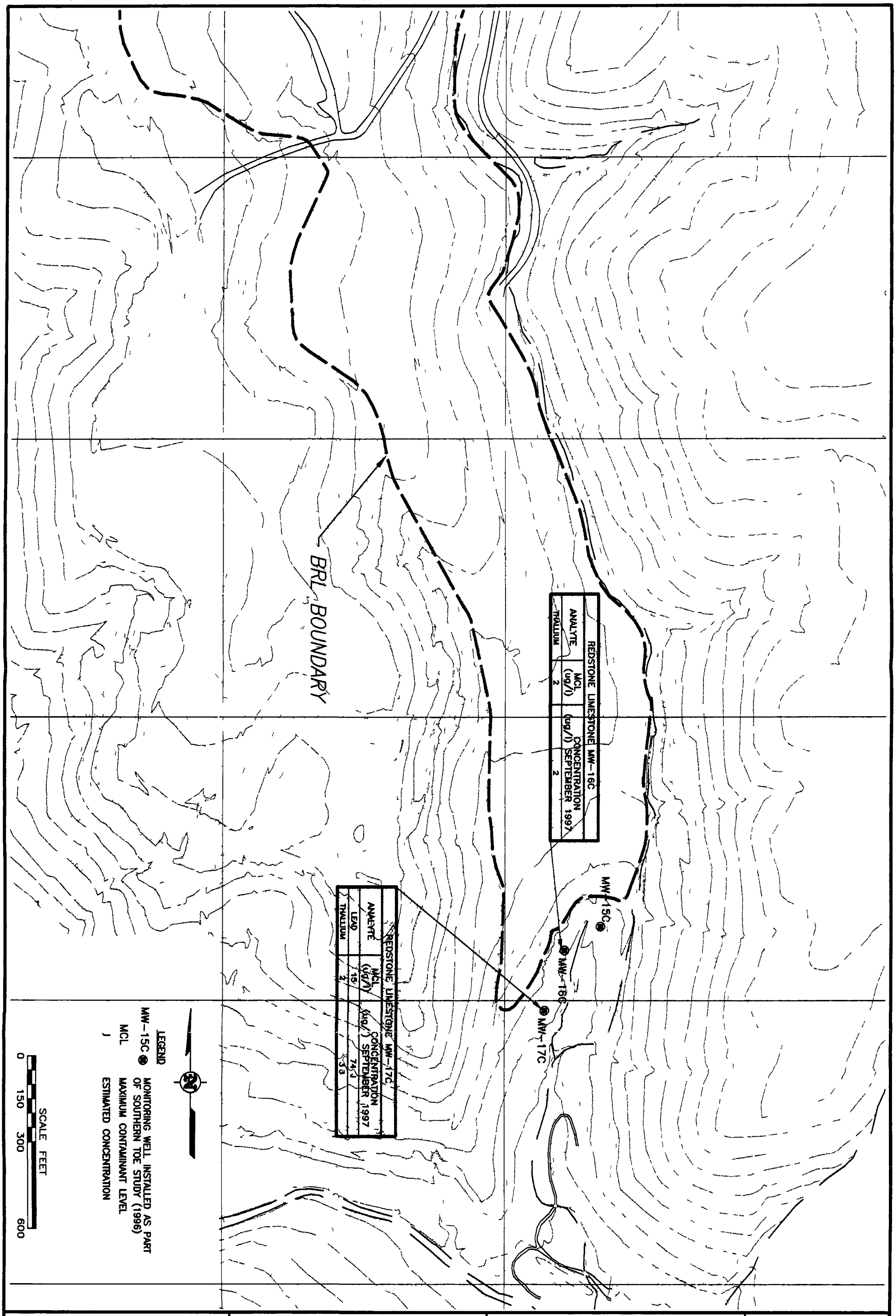



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Figure 4-3

GROUNDWATER SAMPLING LOCATIONS WHERE ANALYTE CONCENTRATION EXCEEDS MAXIMUM CONTAMINANT LEVEL (MCL) REDSTONE LIMESTONE SEPTEMBER 1997

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By TMB 12/19/97
Checked:
Approved
Drawing Number 144195-B7

Appendix A - Groundwater Monitoring Plan Summary

**CONSOL Inc**
Consol Plaza
1800 Washington Road
Pittsburgh PA 15241 1421
412 831 4000
Fax 412-831-4916

April 22, 1997

Mary Tierney, Remedial Project Manager
U S Environmental Protection Agency, SR-6J
77 West Jackson Boulevard
Chicago, Illinois 60604

**Re Buckeye Reclamation Landfill**
**Site - Ground Water**
**Monitoring Plan Summary**

Dear Mary

The PRP's initial ground water monitoring proposal was submitted to U S EPA on December 22, 1993 Since that time, considerable discussion, negotiation, debate, field work and data analysis have transpired in an effort to finalize a mutually agreeable long-term ground water monitoring plan for the Buckeye Reclamation Landfill Site (BRL Site) in Belmont County, Ohio Per our conference calls on April 10 and 11, 1997, and the requirement by the lawyers that an acceptable resolution of the ground water monitoring issue be reached by April 23, 1997, a summary of the major components of a long-term ground water monitoring plan for the BRL Site is provided herein

The purposes of the long-term ground water monitoring program at the BRL Site are to identify and characterize background ground water quality representative of pre-landfill conditions at the Site (i e the gob pile prior to 1970), characterize ground water quality downgradient of the landfilled materials (i e municipal/industrial waste) in the appropriate formations, and, determine, through appropriate statistical analyses, whether there is any impact to the local ground water regime due to the landfilling activities at the site

The long-term ground water monitoring program for the BRL Site, as outlined herein is intended to meet the requirements of OAC 3745-27-10, "Ground water monitoring program for a sanitary landfill facility All monitoring well locations proposed for the ' interim, as well as the long-term ground water monitoring program, are based on data generated during the RI/FS and pre-design hydrogeological studies

## L. GROUND WATER MONITORING SYSTEM 3745-27-10(B)

Water-bearing zones of interest (formations) at the BRL Site (in descending order) are **Unconsolidated Materials (Mine Refuse), Wegee Limestone, Waynesburg Coal, Uniontown Sandstone, Benwood Limestone, and, Redstone Limestone**

The **Unconsolidated Materials** are a result of coal mine refuse (spoil, gob) disposal in the Kings Run valley (prior to the 1950s) This formation represents the major aquifer system present on the site, in terms of its capability to store, transmit and/or yield significant amounts of water, it is a "man-made' formation The Buckeye Reclamation Landfill was built directly in the refuse and was operated from 1970 to 1991

An "interim" monitoring program involving specified existing wells/piezometers (annual water level measurements and laboratory analyses of ground water samples) will be performed in the summers of 1997, 1998 and 1999 Full-fledged, long-term monitoring will begin in the spring of 2000, assuming that Phase One RA work has been completed Table 1 lists the wells/piezometers involved, Figure 1 shows their locations

The **Wegee Limestone, Waynesburg Coal and Uniontown Sandstone** are present only in the northern portion of the BRL Site, having been removed by erosion from most of the Kings Run valley The Wegee and Waynesburg have also been eroded away in the vicinity of the Waste Pit, but the Uniontown underlies the Waste Pit Ground water flow direction(s) in these three formations are still in question

Piezometers P-23, 24, 25, 26, 27 and 28 will be installed in the summer of 1997 Water level measurement data will be collected, beginning in the summer of 1997, at the nine locations indicated as "flow direction wells' in Table 1 After four quarters of elevation data are collected, a determination will be made regarding the need, if any, for long-term ground water monitoring wells in these three formations Table 1 lists the wells/piezometers involved, Figures 2 (Wegee), 3 (Waynesburg) and 4 (Uniontown) show their locations

Basically, if eastward flow is indicated in the Wegee, Waynesburg or Uniontown, no additional monitoring wells will be required If monitoring wells are not necessary, some of the piezometers installed in 1997 (Table 1) could be made part of the long-term ground water monitoring program as flow direction wells If monitoring wells are required, they will be installed (in 1998) and made part of the "interim" monitoring program in 1998 and 1999, and part of the long-term ground water monitoring program (in the spring of 2000, assuming that Phase One RA work has been completed)

The **Benwood Limestone** underlies the entire BRL Site, except for a small portion of the Kings Run valley in the vicinity of the Southern Toe and Seep L-4

Wells MW-18B and MW-19B will be installed after the Phase One RA construction effort is completed to the extent that these wells will not impede construction activities (by the fall of 1999 at the latest, assuming that Phase One RA work has been completed) Table 1 lists the wells/piezometers involved, Figure 5 shows their locations Ground water level measurements in the Benwood will begin after MW-18B and MW-19B are installed

An "interim" monitoring program involving MW-11B (annual water level measurements and laboratory analyses of ground water samples) will be performed in the summers of 1997, 1998 and 1999 Full-fledged, long-term monitoring will begin in the spring of 2000, assuming that Phase One RA work has been completed

The **Redstone Limestone** underlies the entire BRL Site and represents the base of the uppermost aquifer system for the Site Ground water flow direction in the Redstone Limestone has been demonstrated to be toward the south (down the King's Run valley) Therefore, ground water monitoring in the Redstone Limestone is limited to the southern portion of the Site

An "interim" monitoring program (annual water level measurements and analyses of ground water samples) will be performed in the summers of 1997, 1998 and 1999 Full-fledged, long-term monitoring will begin following the completion of Phase One RA construction activities (probably in the spring of 2000, assuming that Phase One of the RA work is completed in the fall of 1999) Table 1 lists the wells/piezometers involved, Figure 6 shows their locations

## II GROUND WATER DETECTION MONITORING PROGRAM 3745-27-10(D)

An "interim ground water monitoring program, involving existing wells that will be part of the long-term ground water monitoring program (Table 1) will be performed annually in the summers of 1997, 1998 and 1999 Ground water samples will be collected and analyzed for all of the parameters listed in Table 2 Flow direction wells involved in this "interim" monitoring program are listed in Table 1

Flow directions will also be determined from water level measurements in the Waste Pit area for four quarters, beginning in the summer of 1997 Table 1 lists the wells/piezometers involved, Figure 2 (Wegee Limestone), Figure 3 (Waynesburg Coal), and Figure 4 (Uniontown Sandstone) show their locations This flow direction information will be evaluated to determine the need, if any, for monitoring wells in the Wegee, Waynesburg and/or Uniontown formations

During the full-fledged, long-term ground water monitoring effort at the BRL Site, quarterly samples will be collected during the first full year of sampling from downgradient and background monitoring wells screened in units within the uppermost aquifer system, see Table 1 for the wells involved These samples will be analyzed for all of the parameters listed in Table 2 This sampling will begin as soon as monitoring well installation is complete by the spring of 2000, assuming that Phase One RA construction has been completed

Subsequent to the first full year of sampling, downgradient and background monitoring wells screened within units in the uppermost aquifer system (Table 1) will be sampled semiannually and analyzed for all of the parameters listed in Table 2

It is noted that there are provisions in OAC 3745-27-10 that allow alternative parameters, sampling frequencies and/or statistical analysis frequencies, Sections (D) (2), (3), (4) and (6) If appropriate, and based on data collected during the first full year of sampling, or subsequent sampling period(s), written request(s) for changes will be submitted, in accordance with these rules

Also, future evaluation of data collected from the long-term ground water monitoring program at the BRL Site may indicate the presence of a "significant zone of saturation," as defined in OAC 3745-27-01 (FFF) A written request to classify one or more of the water bearing units as a significant zone of saturation may be submitted for agency approval if the continuing evaluation of the hydrogeology at the BRL Site, per OAC 3745-27-10, warrants such a designation

## III GROUND WATER SAMPLING, ANALYSIS,AND STATISTICAL METHODS (3745-27-10(C))

A written Sampling and Analysis Plan (SAP), documenting the sampling and analysis procedures to be used in this "ground water detection monitoring program, ' and responsive to OAC 3745-27-10(C) requirements, will be prepared The SAP will contain applicable material from the SAP and the Quality Assurance Project Plan (QAPP) approved in the Remedial Design Work Plan (RD Work Plan) for the BRL Site The SAP will, however, include any Ohio requirements that differ from those used for the RD Work Plan and exclude material from the RD Work Plan SAP and QAPP that are not required by Ohio

The PRPs will select a statistical method to be used to evaluate the ground water data collected, per OAC 3745-27-10(C), after data collection is initiated, with agency concurrence

Ground water elevations will be measured, in all wells prior to any purging and/or sampling The direction of ground water flow for units within the uppermost aquifer system will be determined each time ground water elevation measurements are obtained Ground water flow data will be evaluated annually, at a minimum, using data collected from the "flow direction wells" listed in Table 1

The establishment of background ground water quality for the BRL Site is not straightforward The wells to be used as "background" wells must not be influenced by the municipal/industrial waste However, they must be influenced by the older, mine refuse (gob) which predates landfill establishment and is considered background for purposes of the contamination the ground water monitoring system is designed to address It is possible that the background locations selected for monitoring the formations of interest at the BRL Site will not be hydraulically upgradient of the limits of municipal/industrial waste in the Kings Run valley, because of the difficulty related to finding suitable locations There is some possibility that the background wells could be located in the Unnamed Run valley to the west of the Site which contains similar coal refuse material, but does not appear to be impacted by the municipal/industrial waste in the Kings Run valley In other words it is possible that following further discussions between the PRPs and the agencies, background locations other than hydraulically upgradient wells, will prove to be more representative of background water quality than would typical upgradient wells

The PRPs and the agencies will continue to evaluate existing data while determining suitable background monitoring locations for the long-term ground water monitoring program at the BRL Site The selection of background monitoring locations will be completed, to the mutual satisfaction of the agencies and the PRPs, and in accordance with OAC 3745-27-10 requirements

Please call me at (412) 831-4528 if you have any questions or comments

Sincerely,

J G Gleich
Buckeye Reclamation Project
Coordinator

GG97 063

cc Mary Tierney (3 copies)
Peter Thompson (2 copies)
Kathy McClanahan (2 copies)
Doug Evans (1 copy)
Dennis Hughes (1 copy)

Table 1

**Groundwater Monitoring Program Summary**
**Buckeye Reclamation Lnadfill**
**Belmont County, Ohio (a)**

| Formation | Downgradient Wells | Flow Direction Wells | Background Wells |
|---|---|---|---|
| Unconsolidated Materials (b) | P-1B P 2 P-4 and P 22 | P 1B P 2 P-4 P-13, and P-22 | TBD |
| Wegee Limestone | TBD | MW-3AA, MW 5AA and P-19 | TBD |
| Waynesburg Coal | TBD | P 23 P-24 and P 25 | TBD |
| Uniontown Sandstone | TBD | P 26, P 27, and P-28 | TBD |
| Benwood Limestone | MW 11B (c) MW 18B and MW 19B | MW-11B (c) MW-18B, and MW-19B | TBD |
| Redstone Limestone (b) | MW-15C MW-16C, and MW 17C | MW-15C MW-16C and MW-17C | TBD |

a/ P=piezometer MW=monitoring well TBD=to be determined
b/ All wells shown will be included in interim monitoring program
c/ Well included under interim monitoring program

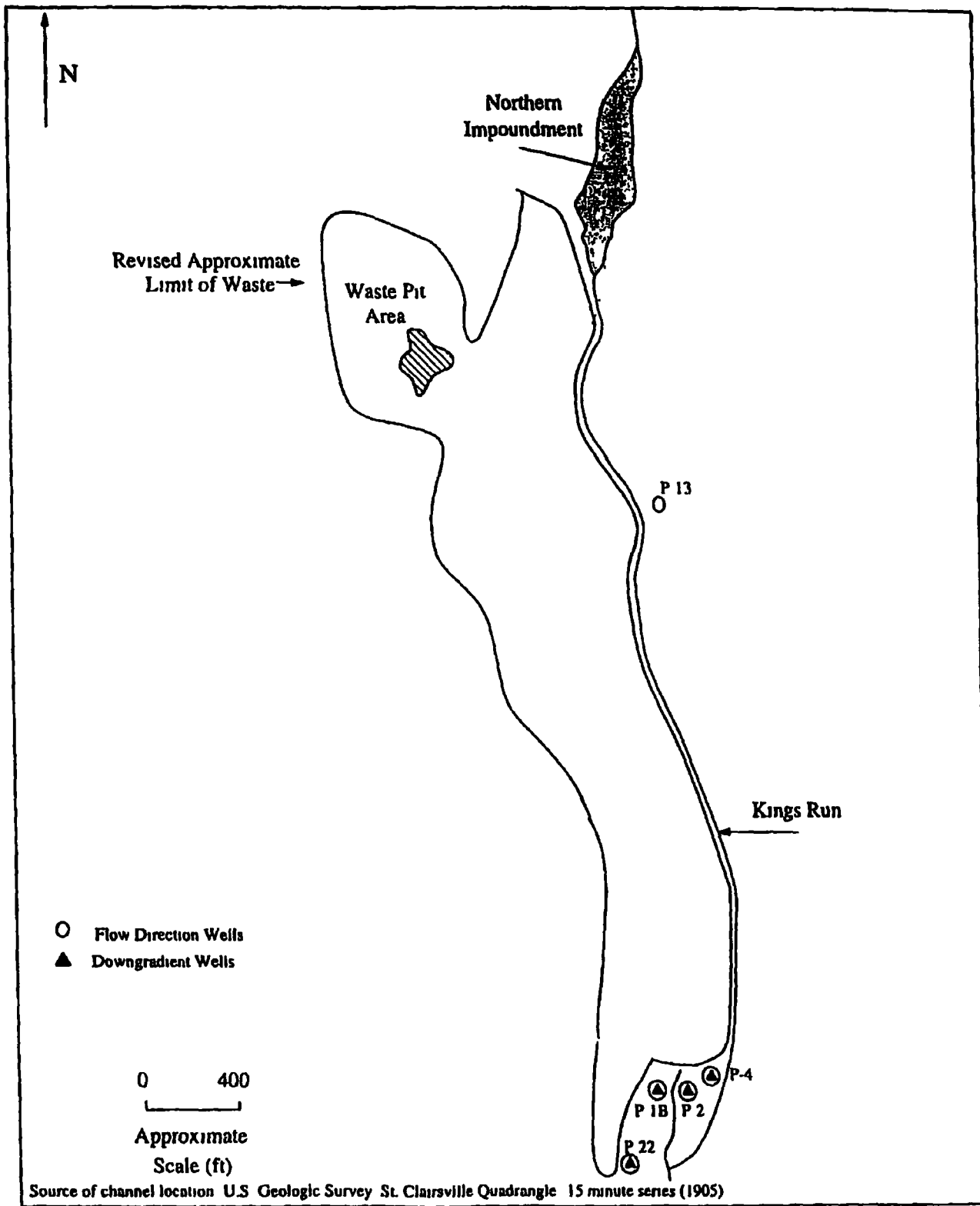
140959\buckeye1 xls

# TABLE 2

| Compound | CAS RN |
|---|---|
| 1) Antimony | See note 3 |
| 2) Arsenic | See note 3 |
| 3) Barium | See note 3 |
| 4) Beryllium | See note 3 |
| 5) Cadmium | See note 3 |
| 6) Chromium | See note 3 |
| 7) Cobalt | See note 3 |
| 8) Copper | See note 3 |
| 9) Lead | See note 3 |
| 10) Nickel | See note 3 |
| 11) Selenium | See note 3 |
| 12) Silver | See note 3 |
| 13) Thallium | See note 3 |
| 14) Vanadium | See note 3 |
| 15) Zinc | See note 3 |
| 16) Acetone | 67-64-1 |
| 17) Acrylonitrile | 107-13-1 |
| 18) Benzene | 71-43-2 |
| 19) Bromocholoromethane | 74-97-5 |
| 20) Bromodicholoromethane | 75-27-4 |
| 21) Bromoform, Tribromomethane | 75-25-2 |
| 22) Carbon disulfide | 75-15-0 |
| 23) Carbon tetrachloride | 56-23-5 |
| 24) Chlorobenzene | 108-90-7 |
| 25) Chloroethane Ethyl cloride | 75-00-3 |
| 26) Chloroform, Trichloromethane | 67-66-3 |
| 27) Dibromochloromethane; Chlorodibromomethane | 124-48-1 |
| 28) 1,2-Dibromo-3-chloropropane; DBCP | 96-12-8 |
| 29) 1,2-Dibromomethane; Ethylene dibromide; EDB | 106-93-4 |
| 30) o-Dichlorobenzene 1,2-Dichlorobenzene | 95-50-1 |
| 31) p-Dichlorobenzene 1,4-Dichlorobenzene | 106-46-7 |
| 32) trans-1,4-Dichloro-2-butene | 110-57-6 |
| 33) 1,1-Dichloroethane; Ethylidene chloride | 75-34-3 |
| 34) 1,2-Dichloroethane; Ethylidene dichloride | 107-06-2 |
| 35) 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride | 75-35-4 |
| 36) cis-1,2-Dichlorothylene; cis-1,2-Dichloroethene | 156-59-2 |
| 37) trans-1,2-Dichloroethylene trans-1,2-Dichloroethene | 156-60-5 |
| 38) 1,2-Dichloropropane; Propylene dichloride | 78-87-5 |
| 39) cis-1,3-Dichloropropene | 10061-01-5 |
| 40) trans-1,3-Dichloropropene | 10061-02-6 |
| 41) Ethylbenzene | 100-41-4 |
| 42) 2-Hexanone; Methyl butyl ketone | 591-78-6 |
| 43) Methyl bromide; Bromomethane | 74-83-9 |
| 44) Methyl chloride, Chloromethane | 74-87-3 |
| 45) Methylene bromide Dibromomethane | 74-95-3 |
| 46) Methylene chloride; Dichloromethane | 75-09-2 |
| 47) Methyl ethyl ketone; MEK; 2-Butanone | 78-93-3 |
| 48) Methyl iodide Iodomethane | 74-88-4 |
| 49) 4-Methyl-2-pentanone; Methyl isobutyl ketone | 108-10-1 |
| 50) Styrene | 100-42-5 |
| 51) 1,1,1 2-Tetrachloroethane | 630-20-6 |
| 52) 1 1 2,2-Tetrachloroethane | 79-34-5 |
| 53) Tetrachloroethylene; Tetrachloroethene; Perchloroethylene | 127-18-4 |
| 54) Toluene | 108-88-3 |
| 55) 1 1 1-Trichloroethane; Methylchloroform | 71-55-6 |
| 56) 1 1 2-Trichloroethane | 79-00-5 |
| 57) Trichloroethylene Trichloroethene | 79-01-6 |

## TABLE 2 (continued)

| | |
|---|---|
| 58) Trichloroflouromethane; CFC-11 | 75-69-4 |
| 59) 1,2,3-Trichloropropane | 96-18-4 |
| 60) Vinyl acetate | 108-05-4 |
| 61) Vinyl chloride | 75-01-4 |
| 62) Xylenes | See note 4 |
| 63) Ammonia | |
| 64) Chloride | |
| 65) Sodium | |
| 66) Chemical oxygen demand | |
| 67) Temperature | |
| 68) pH | |
| 69) Specific conductance | |
| 70) Total dissolved solids | |
| 71) Total alkalinity | |
| 72) Nitrate-nitrite | |
| 73) Sulfate | |
| 74) Magnesium | |
| 75) Calcium | |
| 76) Potassium | |
| 77) Turbidity | |
| 78) Iron | |
| 79) Manganese | |
| 80) Anthracene | |
| 81) Benzo(a)anthracene | |
| 82) Benzo(k)fluoranthene | |
| 83) 3 4 Benzofluoranthene | |
| 84) Benzo(b)fluoranthene | |
| 85) Benzo(g,h,i)perylene | |
| 86) Benzo(a)pyrene | |
| 87) Chrysene | |
| 88) Dibenzo(a,h)anthracene | |
| 89) Fluorine | |
| 90) Indeno(1 2 3 c,d)pyrene | |
| 91) Naphthalene | |
| 92) Phenanthrene | |
| 93) Pyrene | |
| 94) Bis(2-ethylhexyl)phthalate | |




Source of channel location U.S Geologic Survey St. Clairsville Quadrangle 15 minute series (1905)

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(412) 787 5100

Figure 1

Proposed Groundwater Monitoring Locations
Unconsolidated Materials
Buckeye Reclamation Landfill
Belmont County Ohio

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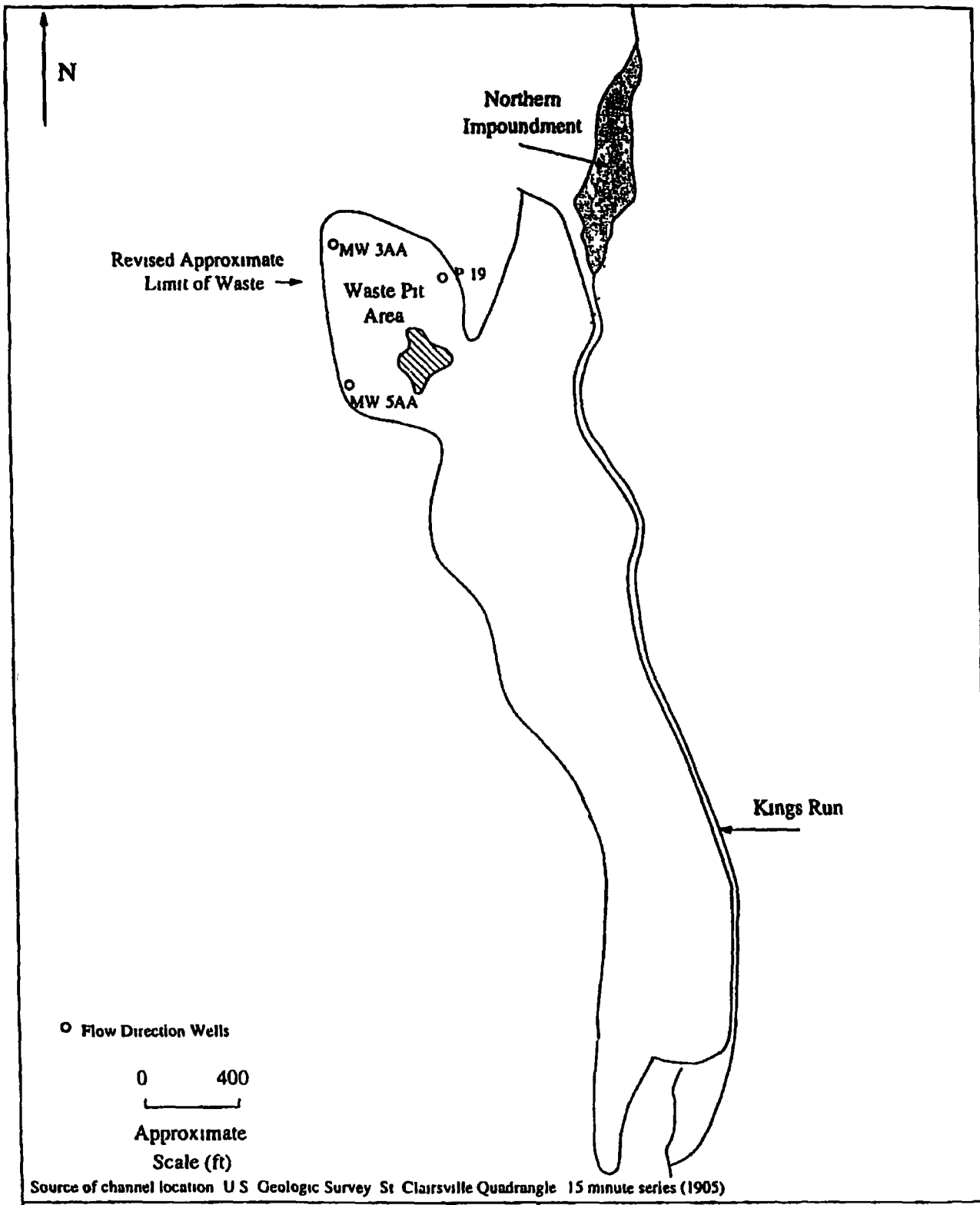


Source of channel location U S Geologic Survey St Clairsville Quadrangle 15 minute series (1905)

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Pittsburgh Pennsylvania 15276
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Figure 2

Proposed Groundwater Flow Direction
Monitoring Locations
Wegee Limestone
Buckeye Reclamation Landfill
Belmont County Ohio

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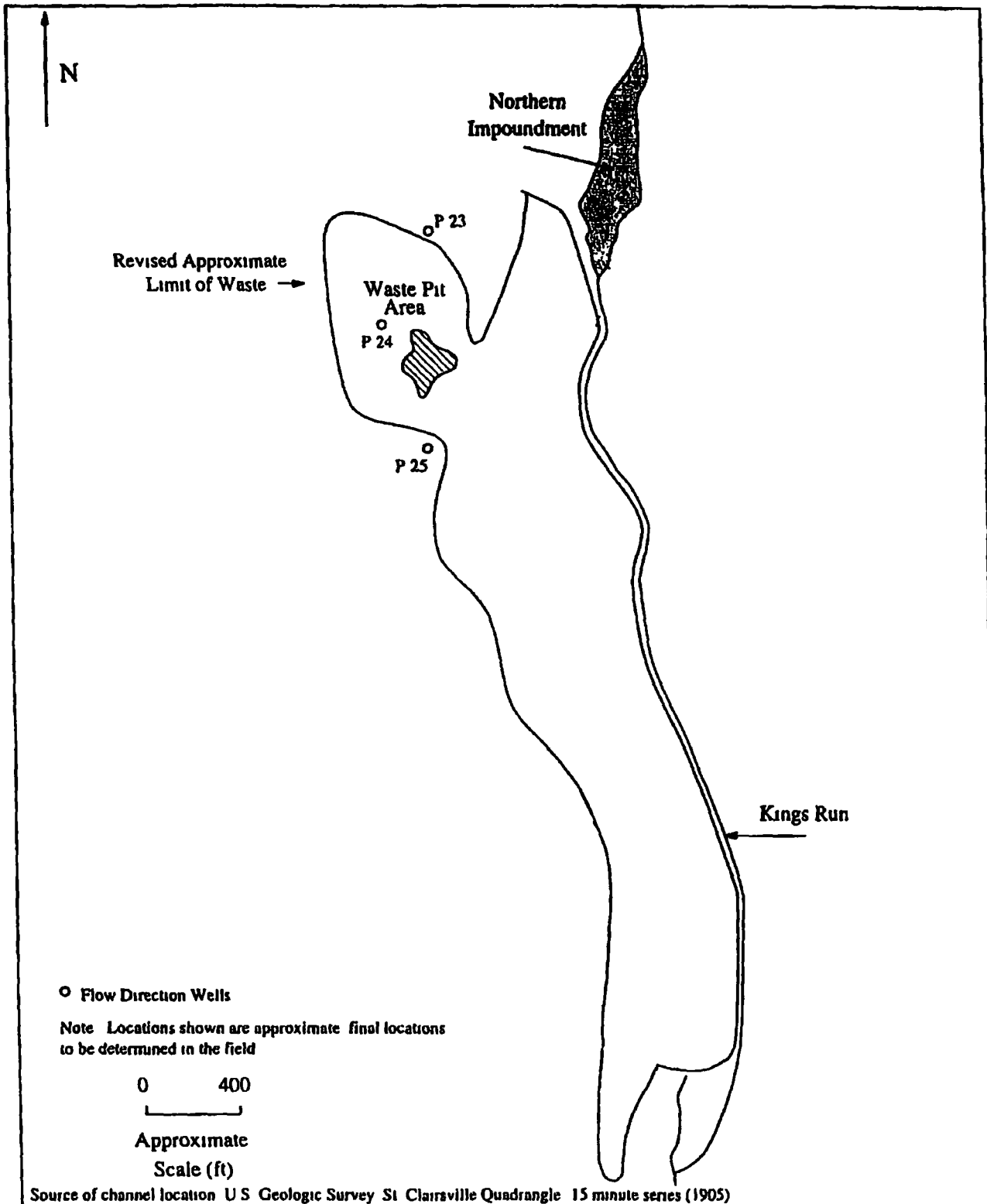


Source of channel location U S Geologic Survey St Clairsville Quadrangle 15 minute series (1905)

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Figure 3

Proposed Groundwater Flow Direction
Monitoring Locations
Waynesburg Coal
Buckeye Reclamation Landfill
Belmont County Ohio

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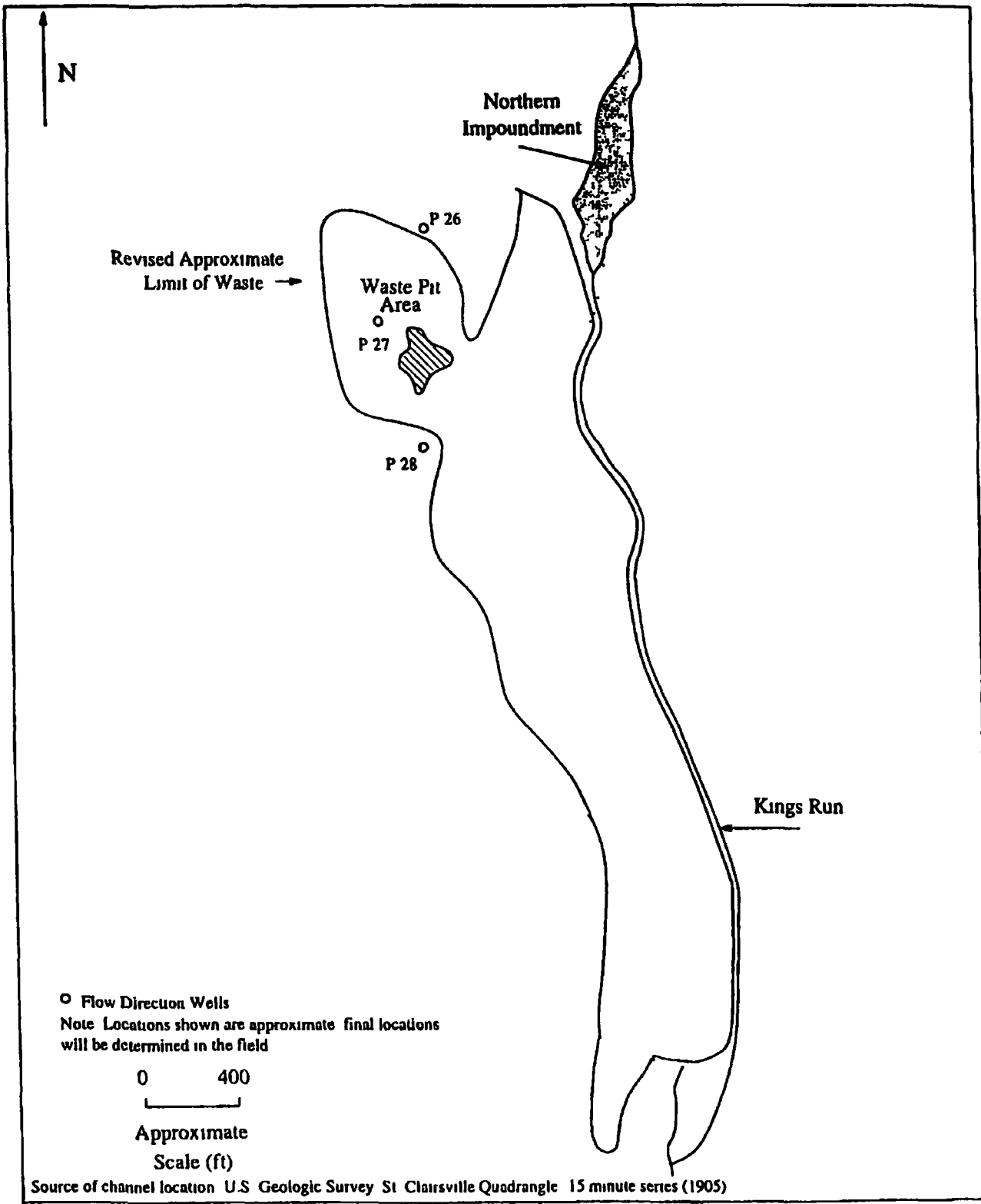


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Pittsburgh Pennsylvania 15276
(412) 787 5100

Figure 4

Proposed Groundwater Flow Direction
Monitoring Locations
Uniontown Sandstone
Buckeye Reclamation Landfill
Belmont County Ohio

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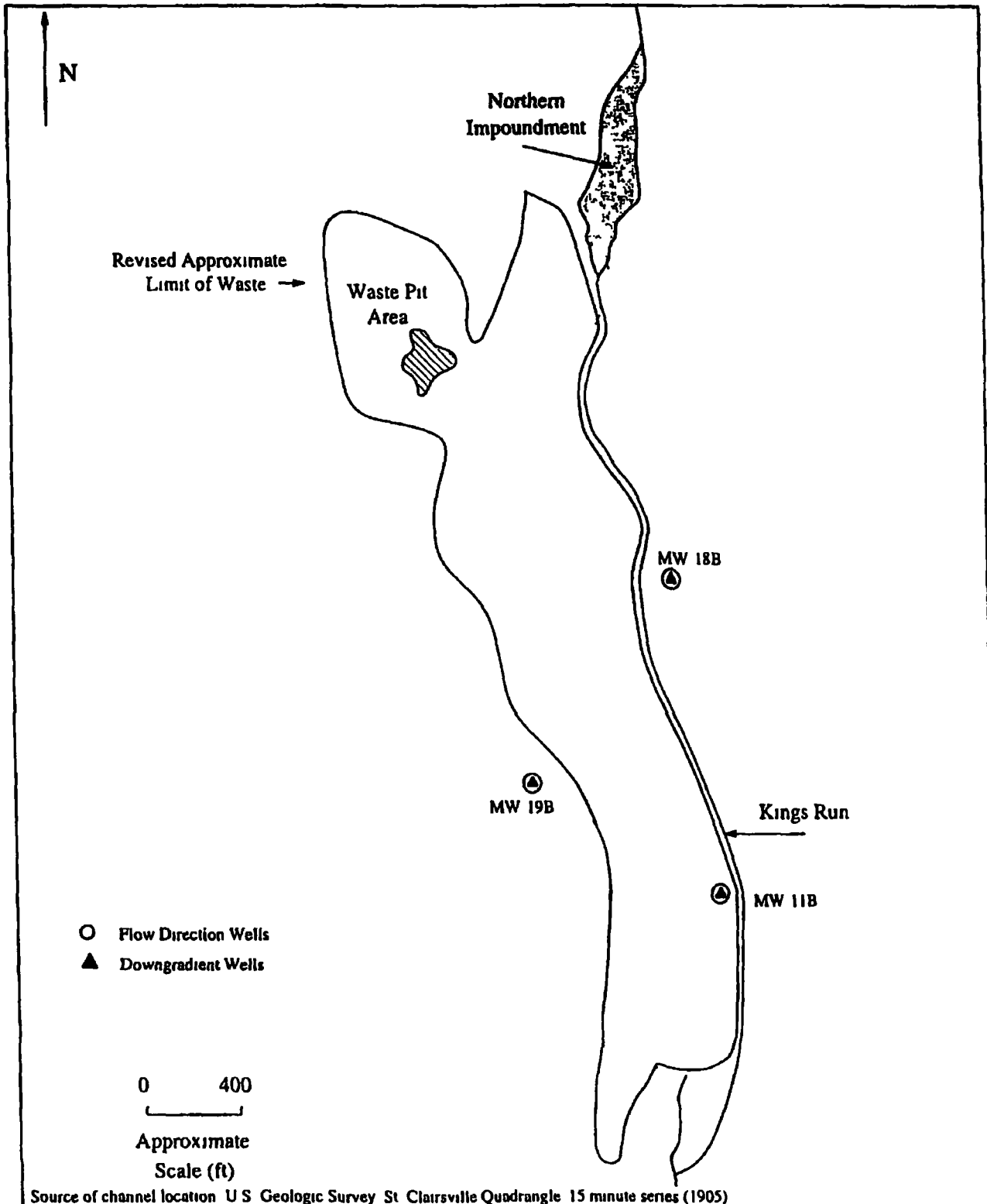


Source of channel location U S Geologic Survey St Clairsville Quadrangle 15 minute series (1905)

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Pittsburgh Pennsylvania 15276
(412) 787 5100

Figure 5

Proposed Groundwater Monitoring Locations
Benwood Limestone
Buckeye Reclamation Landfill
Belmont County Ohio

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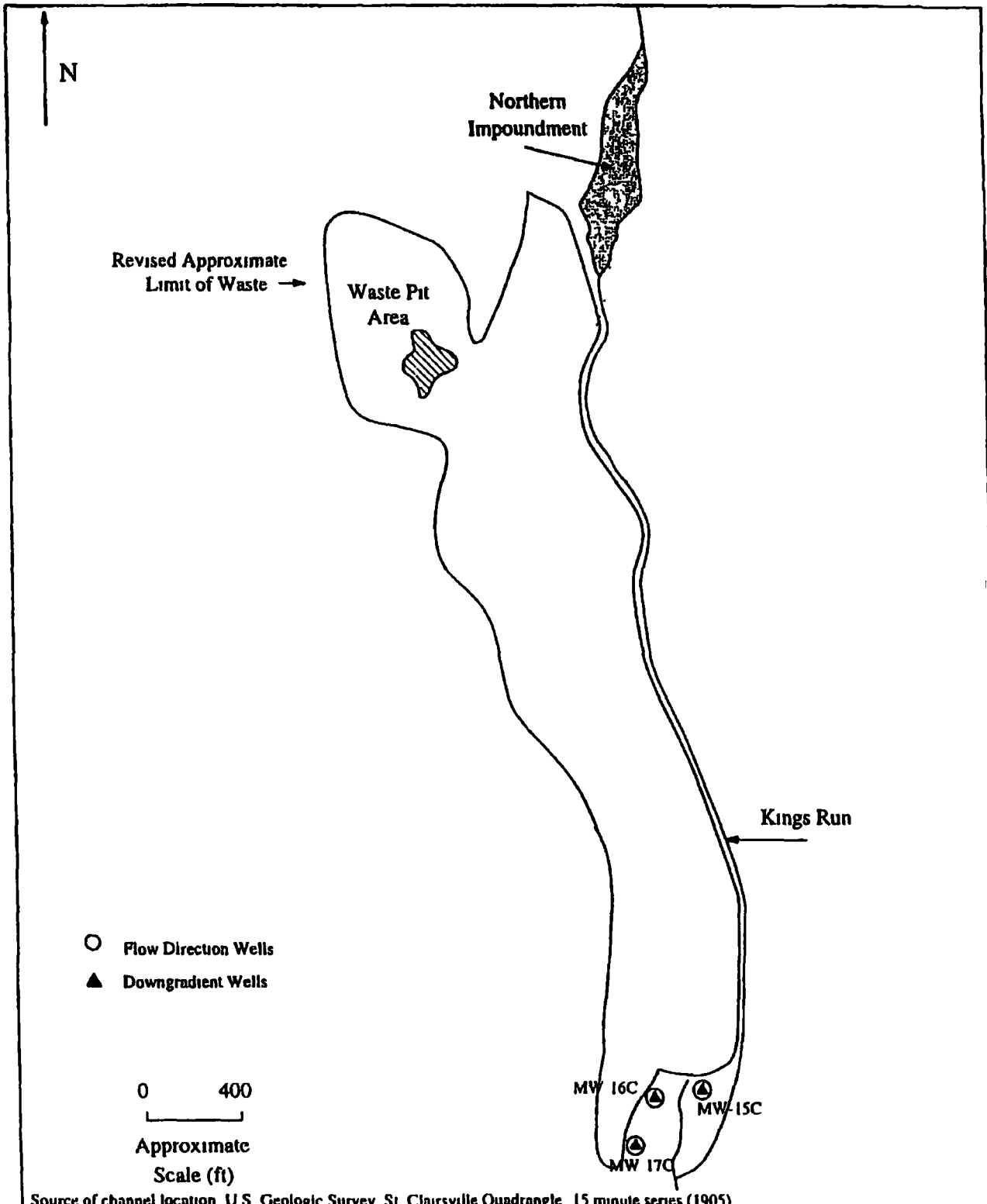


Source of channel location U S Geologic Survey St Clairsville Quadrangle 15 minute series (1905)

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Figure 6

Proposed Groundwater Monitoring Locations
Redstone Limestone
Buckeye Reclamation Landfill
Belmont County Ohio

f \lotus\pa959 \seep2 6

Appendix B – Groundwater Monitoring Data Log Forms

## GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-11B Date. 9/22/97

**Site Data**

Site Name Bucheye / ESC Personnel. EMR/BCB

Site Address _____ ESC Project No . 14495-1

Weather Conditions. partly cloudy, temp. ~ 70°F, light SW wind

**Well Description**

Well Location _____

Well Security. locking protective casing

Casing Material Inner PVC Outer metal

Well (Stick up) or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

**Note: Allow water level to equilibrate after removing well cap**

Total Well Depth (TD) 39.05 ft Depth to Water (DTW) 21.63 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol (gal ) = $(CID)^2(0.041)(TD-DTW)$

Well Volume 2.8 gal x 3 = Purge Volume 8.4 gal

22
20
40

Purge Time Begin 1435 End 1500

Prepurge Data Temp 14.2°C pH 7.90 Spec Cond 2.70 mS/cm

28 Volume 1 Temp 13.2°C pH 7.60 Spec Cond 2.36 mS/cm

56 Volume 2 Temp 13.5°C pH 7.48 Spec Cond 2.14 mS/cm

84 Volume 3 Temp 13.7°C pH 7.23 Spec Cond 2.08 mS/cm

turbidity 53 NTUs alkalinity 440 mg/l

Volume Purged 8.5 gals Purged Dry Yes (No)

Disposal Method For Purge Water holding Tank @ decon area

**Water Description**

Odor. prepurge _____ postpurge _____

Color: prepurge _____ postpurge _____

Sediment Suspended clear Particulates clear

**Sampling Data**

Sampling Method teflon bailer

Sampling Time Begin 1505 End 1535

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other: PAH/B(ZEH)P, chloride, ammonia, alkalinity, TDS, COD, nitrate, sulfate, pH, turbidity, spec. cond.

Comments * MW-60 is a duplicate of MW-11B

## GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-15C Date. 9/23/97

**Site Data**

Site Name Buckeye ESC Personnel: EMR/BCB

Site Address. _____ ESC Project No : 14495-1

Weather Conditions. cloudy, light rain

**Well Description**

Well Location southern tree area

Well Security locking protective casing

Casing Material Inner PVC Outer metal

Well (Stick up) or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

**Note: Allow water level to equilibrate after removing well cap**

Total Well Depth (TD) 54.25 ft Depth to Water (DTW) 41.91 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol (gal ) = $(CID)^2 (0.041) (TD-DTW)$

Well Volume 2 gal x 3 = Purge Volume 6 gal

Purge Time Begin 0945 End 1015

Prepurge Data Temp 13.7°C pH 6.32 Spec. Cond 3.77 mS/cm

2 Volume 1 Temp 13.6°C pH 6.19 Spec Cond 3.77 mS/cm

4 Volume 2 Temp 13.6°C pH 6.18 Spec Cond 3.77 mS/cm

6 Volume 3 Temp 13.7°C pH 6.22 Spec Cond 3.80 mS/cm

turbidity 504 NTUs alkalinity 620 mg/L

31
20
620

Volume Purged 6 gals Purged Dry Yes (No)

Disposal Method For Purge Water holding tank

**Water Description**

Odor· prepurge _____ postpurge _____

Color prepurge _____ postpurge _____

Sediment· Suspended _____ Particulates _____

**Sampling Data**

Sampling Method. teflon bailer

Sampling Time Begin 1025 End _____

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other PAHs/B(2EH)P, ammonia, COD, alkalinity, TDS, nitrate, sulfate, chloride, pH, turbidity, spec cond.

Comments _____

## GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-16C Date 9/23/97

**Site Data**

Site Name Buckeye ESC Personnel. EMR/BCB

Site Address _____ ESC Project No . 14495-1

Weather Conditions. partly, temp ~65°F

**Well Description**

Well Location southern toc

Well Security locking protective casing

Casing Material Inner PVC Outer metal

Well Stick up or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

**Note: Allow water level to equilibrate after removing well cap**

Total Well Depth (TD) 49.40 ft Depth to Water (DTW) 41.20 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol.(gal ) = $(CID)^2(0\ 041)(TD-DTW)$

Well Volume 1.3 gal x 3 = Purge Volume 3.9 gal

Purge Time. Begin 1550 End _____

Prepurge Data Temp 14.9°C pH 5.77 Spec. Cond 3.92 mS/cm

1.3 Volume 1 Temp 14.5°C pH 5.97 Spec Cond 3.99 mS/cm

2.6 Volume 2 Temp 14.5°C pH 5.98 Spec Cond 3.95 mS/cm

3.9 Volume 3 Temp 14.6°C pH 5.82 Spec Cond 3.90 mS/cm

turbidity 91 NTUs alkalinity 740 mg/l

37 ≥ 0 / 74°

Volume Purged 4 gals Purged Dry Yes (No)

Disposal Method For Purge Water holding tank

**Water Description**

Odor prepurge _____ postpurge _____

Color prepurge clear postpurge slightly cloudy

Sediment: Suspended _____ Particulates _____

**Sampling Data**

Sampling Method teflon bailer

Sampling Time Begin 1610 End 1630

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other PAH/D(2EH)P, ammonia, COD, alkalinity, TDS, nitrate, sulfate, chloride, pH, turbidity, spec cond.

Comments _____

## GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-17C Date 9/23/97

**Site Data**

Site Name Buckeye ESC Personnel. EMR/BCB

Site Address _____ ESC Project No . 144195-1

Weather Conditions cloudy, overcast, temp ~60°F

**Well Description**

Well Location _____

Well Security locking protective casing

Casing Material Inner PVC Outer metal

Well Stick up or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

**Note· Allow water level to equilibrate after removing well cap**

Total Well Depth (TD) 67.66 ft Depth to Water (DTW) 64.40 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol (gal ) = $(CID)^2$(0 041)(TD-DTW)

Well Volume 0 5 gal x 3 = Purge Volume 1 6 gal

Purge Time Begin 1135 End 1150

Prepurge Data Temp 14.0°C pH 6.91 Spec Cond 298 mc/cm

0 5 Volume 1 Temp 13.9°C pH 6.80 Spec Cond 3.05 mc/cm

1 0 Volume 2 Temp 13.8°C pH 6.76 Spec Cond 3.06 mc/cm

1 6 Volume 3 Temp 14.0°C pH 6.74 Spec Cond 307 mc/cm

turbidity 97 NTUs alkalinity 760 mg/l

Volume Purged 1.6 Purged Dry (Yes) No

Disposal Method For Purge Water holding tank

**Water Description**

Odor prepurge _____ postpurge _____

Color: prepurge clear postpurge cloudy, gray

Sediment. Suspended yes Particulates yes

**Sampling Data**

Sampling Method teflon bailer

Sampling Time Begin 1410 End 1530

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other PAHs / B(2EH)P, ammonia, COD, nitrate, sulfate, chloride, pH, turbidity, spec cond.

Comments

* well purged dry - let recharge before sampling

## GROUNDWATER MONITORING DATA LOG

Well No /Designation P-1B Date 9/24/97

**Site Data**

Site Name Buckeye ESC Personnel. EMR/BCB

Site Address. _____ ESC Project No . 144195-1

Weather Conditions. partly cloudy, temp ~ 50°F

**Well Description**

Well Location _____

Well Security. locking protective casing

Casing Material Inner PVC Outer metal

Well Stick up or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

**Note: Allow water level to equilibrate after removing well cap**

Total Well Depth (TD) 23.81 ft Depth to Water (DTW) 10.49 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol (gal ) = $(CID)^2(0.041)(TD-DTW)$

Well Volume 2.1 gal x 3 = Purge Volume 6.4 gal

Purge Time Begin 0845 End 0920

Prepurge Data Temp 14.3 °C pH 4.87 Spec Cond 241 ms/cm

2.1 Volume 1 Temp 12.7 °C pH 3.88 Spec Cond 3.54 ms/cm

4.2 Volume 2 Temp 12.6 °C pH 3.77 Spec Cond 3.73 ms/cm

6.4 Volume 3 Temp 12.4 °C pH 3.72 Spec Cond 3.82 ms/cm

turbidity 390 NTUs alkalinity < 20 mg/L

Volume Purged 6.4 gals. Purged Dry (Yes) No

Disposal Method For Purge Water. holding tank

**Water Description**

Odor prepurge _____ postpurge _____

Color. prepurge _____ postpurge _____

Sediment: Suspended _____ Particulates _____

**Sampling Data**

Sampling Method teflon bailer

Sampling Time Begin 1015 End 1045

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other. PAH's/B(2EH)P, ammonia, TDS, nitrate, sulfate, alkalinity, pH, turbidity, spec cond.

Comments *groundwater samples collected from P-1B using bailer @ 1045h filter used to pour FB092497 (field blank)

## GROUNDWATER MONITORING DATA LOG

Well No /Designation P-2 Date 9/23/97

**Site Data**

Site Name Buckeye ESC Personnel. EMR/BCB

Site Address. ESC Project No . 14495-1

Weather Conditions partly cloudy, temp ~50°F

**Well Description**

Well Location

Well Security locking protective casing

Casing Material Inner PVC Outer metal

Well (Stick up) or Depth Below Ground Surface

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

**Note: Allow water level to equilibrate after removing well cap**

Total Well Depth (TD) 15.17 ft Depth to Water (DTW) 3.63 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol (gal ) = $(CID)^2 (0\ 041) (TD-DTW)$

Well Volume 1.85 gal x 3 = Purge Volume 5.5 gal

Purge Time Begin 0840 End 0900

Prepurge Data Temp 16.3°C pH 6.40 Spec. Cond 270 ms/cm

1.8 Volume 1 Temp 14.1°C pH 6.32 Spec Cond 2.74 ms/cm

3.6 Volume 2 Temp 13.9°C pH 6.25 Spec Cond 2.66 ms/cm

5.5 Volume 3 Temp 13.8°C pH 6.26 Spec Cond 2.71 ms/cm

turbidity 490 NTUs alkalinity 820 mg/l

41 20 20

Volume Purged 5.5 gals Purged Dry Yes (No)

Disposal Method For Purge Water. holding tank

**Water Description**

Odor prepurge _____ postpurge _____

Color prepurge _____ postpurge _____

Sediment Suspended yes Particulates yes

**Sampling Data**

Sampling Method tefton bailer

Sampling Time Begin 0900 End 0920

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other PAHs/B(2EH)P, ammonia, COD, alkalinity, TDS, nitrate, sulfate, chloride, pH, turbidity, spec. cond.

Comments _____

## GROUNDWATER MONITORING DATA LOG

Well No /Designation P-4 Date 9/22/97

**Site Data**

Site Name Buckeye ESC Personnel EMR/BCB

Site Address _____ ESC Project No 144195-1

Weather Conditions. partly cloudy/sunny, warm ~70°F, light SW wind

**Well Description**

Well Location _____

Well Security locking protective casing (metal)

Casing Material Inner PVC Outer metal

Well (Stick up) or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

Note: Allow water level to equilibrate after removing well cap

Total Well Depth (TD) 25.27 ft Depth to Water (DTW) 11.84 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol (gal ) = $(CID)^2(0\ 041)(TD-DTW)$

Well Volume 2.2 gal x 3 = Purge Volume 6.6 gal

Purge Time Begin 1610 End 1625

Prepurge Data Temp 16.2°C pH 6.36 Spec Cond 3.01 ms/cm

2.2 Volume 1 Temp 15.1°C pH 5.85 Spec Cond 3.34 ms/cm

4.4 Volume 2 Temp 14.6°C pH 5.92 Spec Cond 3.37 ms/cm

6.6 Volume 3 Temp 14.6°C pH 5.87 Spec Cond 3.37 ms/cm

turbidity >1,000 NTUs alkalinity >1,000 mg/l. (* high sediment content)

Volume Purged 6.6 gals Purged Dry Yes (No)

Disposal Method For Purge Water holding tank

**Water Description**

Odor prepurge _____ postpurge _____

Color prepurge _____ postpurge _____

Sediment Suspended yes Particulates yes

**Sampling Data**

Sampling Method teflon bailer

Sampling Time Begin 1635 End 1650

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other PAH/B(2EH)P, chloride, ammonia, alkalinity, TDS, COD, nitrate, sulfate, pH, turbidity, spec. cond.

Comments _____

**GROUNDWATER MONITORING DATA LOG**

Well No /Designation P-22 Date 9/23/97

**Site Data**

Site Name Buckeye ESC Personnel EMR/BCB

Site Address _____ ESC Project No . 144195-1

Weather Conditions. cloudy, intermittent rain

**Well Description**

Well Location _____

Well Security locking protective casing

Casing Material Inner PVC Outer metal

Well (Stick up) or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) NA

Reference Point (i e , top of PVC casing) TPVC

**Purge Data**

Purge Method bailing

**Note: Allow water level to equilibrate after removing well cap**

Total Well Depth (TD) 30.67 ft Depth to Water (DTW) 17.25 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol (gal ) = $(CID)^2(0\ 041)(TD-DTW)$

Well Volume 2.15 gal x 3 = Purge Volume 6.4 gal

Purge Time Begin 1430 End 1450

Prepurge Data Temp 14.5°C pH 3.74 Spec Cond 3.37 mS/cm

2.1 Volume 1 Temp 14.0°C pH 4.60 Spec Cond 3.50 mS/cm

4.2 Volume 2 Temp 13.9°C pH 4.61 Spec Cond 3.47 mS/cm

6.4 Volume 3 Temp 14.0°C pH 4.62 Spec Cond 3.72 mS/cm

turbidity 999 NTUs alkalinity 40 mg/l

Volume Purged 64 gals Purged Dry Yes (No)

Disposal Method For Purge Water holding tank

**Water Description**

Odor prepurge _____ postpurge _____

Color. prepurge clear postpurge gray/ cloudy

Sediment. Suspended yes Particulates yes

**Sampling Data**

Sampling Method teflon bailer

Sampling Time Begin 1455 End 1520

Analytical Parameters (Circle Appropriate Parameters)

(VOCs) BNA BNE (Total (Unfiltered) Metals)

(Dissolved (Filtered) Metals) TPH PCB Cyanide

Other PAHs/B(2EH)P, ammonia, COD, alkalinity, TDS, nitrate, sulfate, chloride, pH, turbidity, spec. cond

Comments * MS/MSD sample collected from P-22

Appendix C – Summary Table of Groundwater Analytical Results

**Table A 1**

**Groundwater Sampling Results**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio (ug/l)(a)**
**September 22 24, 1997**

| Compound | CRQL (g) | P 1B | P 2 | P 4 | P 22 | MW 11B | MW 60 (b) | MW 15C | MW 16C | MW 17C | TB092297 (c) | TB092397 (d) | TB092497 (e) | FB092497 (f) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOCs** | | | | | | | | | | | | | | |
| Chloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromomethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Vinyl Chloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methylene Chloride | 5 | 5 BJ | 4 BJ | 4 BJ | 3 BJ | 4 BJ | 5 B | 4 BJ | 5 BJ | 4 BJ | 11 | 9 | 4 J | 4 J |
| Acetone | 5 | 5 BJ | 3 BJ | 16 BJ | 5 BJ | 4 BJ | 3 BJ | 2 BJ | 3 BJ | 2 BJ | 3 J | 2 J | 3 J | 3 J |
| Carbon Disulfide | 5 | 1 J | 5 U | 5 U | 1 J | 2 J | 2 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 Dichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 Dichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| cis 1 2 Dichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| trans 1 2 Dichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromochloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chloroform | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2 Butanone | 5 | 2 BJ | 10 U | 10 U | 10 U | 10 U | 10 U | 1 BJ | 10 U | 1 BJ | 4 J | 10 U | 1 J | 1 J |
| 1 1 1 Trichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Carbon Tetrachloride | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Vinyl Acetate | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dichloropropane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| cis 1 3 Dichloropropene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Dibromochloromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 2 Trichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromoform | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dibromo 3 chloropropane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 4 Methyl 2 Pentanone | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2 Hexanone | 10 | 1 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 1 J | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 2 2 Tetrachloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Styrene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Xylene (total) | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 4 Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dichlorobenzene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Iodomethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Acrylonitrile | 20 | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Dibromomethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dibromomethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 1 2 Tetrachloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 3 Trichloropropane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| trans 1 4 Dichloro 2 butene | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichlorofluoromethane | 5 | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |

**Table A 1 (continued)**

**Groundwater Sampling Results**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio (ug/l)(a)**
**September 22 24, 1997**

| Compound | CRQL (g) | P 1B | P 2 | P 4 | P 22 | MW 11B | MW 60 (b) | MW 15C | MW 16C | MW 17C | TB092297 (c) | TB092397 (d) | TB092497 (e) | FB092497 (f) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SVOCs** | | | | | | | | | | | | | | |
| Naphthalene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| 2 Methylnaphthalene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| 2 Chloronaphthalene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Acenaphthylene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Acenaphthene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Dibenzofuran | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Fluorene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Phenanthrene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Anthracene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Fluoranthene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Pyrene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(a)anthracene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Chrysene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(b)fluoranthene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(k)fluoranthene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(a)pyrene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Indeno(1 2 3-cd)pyrene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Dibenzo(a,h)anthracene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(g h ı)perylene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Bis(2 ethylhexyl)phthalate | 10 | 3 J | 10 U | 1 J | 10 U | 10 U | 10 U | 2 J | 4 J | 3 J | NA | NA | NA | 10 U |

| Analyte | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total Metals (ug/l)** | **IDL (g)** | | | | | | | | | | | | | |
| Antimony | 1 7 | 1 7 UJ | 1 7 UJ | 1 8 UJ | 2 8 J | 2 7 J | 1 7 UJ | 1 7 UJ | 1 7 UJ | 1 7 UJ | NA | NA | NA | 1 7 UJ |
| Arsenic | 3 2 | 65 6 | 3 2 U | 143 | 74 5 | 3 2 U | 3 2 U | 3 2 U | 3 2 U | 26 7 | NA | NA | NA | 3 2 U |
| Barium | 2 4 | 37 6 J | 28 8 J | 979 | 141 J | 21 3 J | 15 6 J | 45 8 J | 31 6 J | 623 | NA | NA | NA | 2 4 U |
| Beryllium | 0 3 | 9 3 | 0 3 U | 4 7 J | 4 5 J | 0 72 J | 0 3 U | 0 87 J | 0 3 U | 1 9 J | NA | NA | NA | 0 3 U |
| Cadmium | 2 0 | 2 U | 0 49 U | 1 3 J | 2 U | 0 54 J | 0 57 J | 0 51 J | 0 4 U | 2 4 J | NA | NA | NA | 0 4 U |
| Calcium | 112 8 | 377000 | 382000 | 616000 | 378000 | 321000 | 319000 | 378000 | 444000 | 75700 | NA | NA | NA | 1440 J |
| Chromium | 6 5 | 19 6 | 6 5 U | 121 | 40 9 | 6 5 U | 6 5 U | 7 6 J | 6 5 U | 43 4 | NA | NA | NA | 6 5 U |
| Cobalt | 7 0 | 88 6 | 7 U | 611 | 65 4 | 11 8 J | 16 3 J | 7 U | 12 7 J | 14 3 J | NA | NA | NA | 7 U |
| Copper | 3 8 | 10 7 J | 3 8 U | 168 | 143 | 3 8 U | 3 8 U | 3 8 U | 3 8 U | 43 8 | NA | NA | NA | 3 8 U |
| Iron | 7 1 | 595000 | 1590 | 157000 | 819000 | 2020 | 2090 | 10900 | 9500 | 22800 | NA | NA | NA | 254 |
| Lead | 1 3 | 21 3 J | 4 4 J | 102 J | 146 J | 1 5 J | 3 2 J | 3 5 J | 1 3 UJ | 74 J | NA | NA | NA | 1 8 J |
| Magnesium | 84 4 | 59400 | 112000 | 172000 | 79400 | 73800 | 71900 | 234000 | 257000 | 27500 | NA | NA | NA | 91 8 J |
| Manganese | 2 3 | 2630 | 724 | 7380 | 3850 | 897 | 893 | 331 | 290 | 185 | NA | NA | NA | 6 4 J |
| Nickel | 7 9 | 370 | 10 7 J | 1070 | 203 | 21 5 J | 24 7 J | 7 9 U | 41 6 | 52 9 | NA | NA | NA | 7 9 U |
| Potassium | 156 7 | 16700 | 1240 J | 24200 | 16200 | 5980 | 4770 J | 7810 | 7400 | 10900 | NA | NA | NA | 157 U |
| Selenium | 66 | 66 U | 3 3 U | 3 3 U | 33 U | 3 3 U | 3 3 U | 3 3 U | 3 3 U | 16 9 | NA | NA | NA | 3 3 U |
| Silver | 1 1 | 3 6 J | 1 1 U | 1 6 J | 5 5 J | 1 6 J | 1 2 J | 1 6 J | 1 1 U | 3 8 | NA | NA | NA | 1 1 U |
| Sodium | 49 5 | 122000 J | 124000 J | 221000 J | 106000 J | 74700 J | 72000 J | 288000 J | 232000 J | 610000 J | NA | NA | NA | 948 J |
| Thallium | 1 5 | 1 5 U | 3 5 J | 12 7 | 1 5 U | 3 8 J | 3 7 J | 1 9 J | 2 J | 3 3 J | NA | NA | NA | 1 5 U |
| Vanadium | 5 3 | 57 3 | 5 3 U | 108 | 40 5 J | 5 3 U | 5 3 U | 5 3 U | 5 3 U | 62 4 | NA | NA | NA | 5 3 U |
| Zinc | 5 0 | 1560 | 17 9 J | 697 | 847 | 14 7 J | 10 4 J | 12 6 J | 20 7 | 65 8 | NA | NA | NA | 6 5 J |

**Table A 1 (continued)**

**Groundwater Sampling Results**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio (ug/l)(a)**
**September 22 24, 1997**

| Analyte | IDL (g) | P 1B | P 2 | P 4 | P 22 | MW 11B | MW 60 (b) | MW 15C | MW 16C | MW 17C | TB092297 | TB092397 | TB092497 | FB092497 (c) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dissolved Metals (ug/l)** | | | | | | | | | | | | | | |
| Antimony | 1 7 | 3 J | 1 7 U | 1 7 U | 3 3 J | 1 7 U | 1 7 U | 1 9 J | 1 7 U | 1 7 U | NA | NA | NA | 1 7 U |
| Arsenic | 3 2 | 52 8 | 3 2 U | 26 8 | 47 7 | 3 2 U | 3 2 U | 3 2 U | 3 2 U | 3 2 U | NA | NA | NA | 3 2 U |
| Barium | 2 4 | 121 J | 20 8 J | 19 7 J | 48 U | 9 2 B | 10 5 J | 7 6 J | 11 9 J | 18 3 J | NA | NA | NA | 2 4 U |
| Beryllium | 0 3 | 8 6 | 1 7 J | 0 3 U | 6 U | 0 3 U | 0 3 U | 0 43 J | 0 43 J | 0 3 U | NA | NA | NA | 0 3 U |
| Cadmium | 2 0 | 8 U | 0 64 J | 0 4 U | 8 U | 0 4 U | 0 4 U | 0 4 U | 0 4 U | 5 7 | NA | NA | NA | 0 4 U |
| Calcium | 112 8 | 348000 J | 352000 J | 445000 J | 426000 J | 283000 J | 302000 J | 343000 J | 436000 J | 64700 J | NA | NA | NA | 1960 J |
| Chromium | 6 5 | 18 3 J | 19 4 J | 6 5 UJ | 130 UJ | 6 5 UJ | 6 5 UJ | 6 5 UJ | 6 5 J | 6 5 UJ | NA | NA | NA | 6 5 UJ |
| Cobalt | 7 0 | 84 5 | 7 U | 14 7 J | 140 U | 11 J | 18 J | 7 U | 7 U | 7 U | NA | NA | NA | 7 U |
| Copper | 3 8 | 4 8 J | 3 8 U | 3 8 U | 76 U | 5 9 J | 18 7 J | 9 1 J | 3 8 U | 5 8 J | NA | NA | NA | 3 8 U |
| Iron | 7 1 | 546000 | 63 3 J | 21400 | 644000 | 2800 | 1430 | 8630 | 3650 J | 101 | NA | NA | NA | 164 |
| Lead | 1 3 | 20 1 J | 2 5 J | 4 3 J | 25 2 J | 1 3 UJ | 1 3 J | 1 3 J | 1 3 J | 69 5 J | NA | NA | NA | 1 7 J |
| Magnesium | 84 4 | 55600 J | 99700 J | 151000 J | 87800 J | 65300 J | 68100 J | 207000 J | 256000 J | 21600 J | NA | NA | NA | 84 4 UJ |
| Manganese | 2 3 | 2470 | 472 | 5920 | 4280 | 677 | 713 | 321 | 265 | 78 2 | NA | NA | NA | 6 4 J |
| Nickel | 7 9 | 354 | 9 9 J | 71 | 193 J | 14 5 J | 28 5 U | 8 3 J | 32 2 J | 7 9 U | NA | NA | NA | 7 9 U |
| Potassium | 156 7 | 15000 | 1350 J | 3110 J | 12700 | 4000 J | 3910 U | 6260 | 7030 | 3720 J | NA | NA | NA | 157 U |
| Selenium | 66 | 66 U | 3 3 U | 3 3 U | 66 U | 3 3 U | 3 3 U | 3 3 U | 3 3 U | 3 3 U | NA | NA | NA | 3 3 U |
| Silver | 1 1 | 3 5 J | 1 1 U | 1 1 U | 5 5 J | 1 1 U | 1 1 U | 1 1 U | 1 1 U | 2 7 J | NA | NA | NA | 1 1 U |
| Sodium | 49 5 | 114000 | 114000 | 240000 | 120000 | 66700 | 69100 | 261000 | 231000 | 738000 | NA | NA | NA | 1300 J |
| Thallium | 1 5 | 8 9 J | 1 5 U | 3 5 J | 3 4 J | 1 9 U | 1 7 J | 2 1 J | 2 1 J | 1 5 U | NA | NA | NA | 1 5 U |
| Vanadium | 5 3 | 61 3 | 5 3 U | 5 3 U | 106 U | 5 3 U | 12 9 J | 7 4 J | 5 3 U | 5 3 U | NA | NA | NA | 5 3 U |
| Zinc | 5 0 | 1490 | 8 J | 12 J | 1500 | 9 2 J | 16 2 J | 10 J | 14 5 J | 12 3 J | NA | NA | NA | 57 1 |
| **Other Analytical Parameters (mg/l)** | **MRL (g)** | | | | | | | | | | | | | |
| Alkalinity | 2 0 | 2 U | 696 | 1080 | 2 U | 402 | 406 | 698 | 776 | 868 | NA | NA | NA | 2 3 |
| Ammonia nitrogen | 0 1 | 3 71 | 0 11 | 1 1 | 3 99 | 0 45 | 0 39 | 1 98 | 1 63 | 2 47 | NA | NA | NA | 0 1 U |
| Chemical oxygen demand | 5 0 | 111 | 15 6 | 850 | 25 | 5 U | 7 2 | 5 U | 30 | 1330 | NA | NA | NA | 9 1 |
| Chloride | 0 1 | 85 8 | 92 3 | 217 | 23 3 | 71 3 | 74 3 | 108 | 120 | 68 9 | NA | NA | NA | 0 1 U |
| Nitrate nitrogen | 0 1 | 0 1 U | 0 1 | 0 11 | 0 1 U | 0 1 U | 0 1 U | 0 1 U | 0 1 U | 2 08 | NA | NA | NA | 0 1 U |
| Nitrite nitrogen | 0 1 | 0 1 U | 0 1 | 0 1 U | 0 067 J | 0 1 U | 0 1 U | 0 1 U | 0 1 U | 0 1 U | NA | NA | NA | 0 1 U |
| pH (units) | NA | 3 47 | 6 23 | 6 41 | 4 6 | 6 67 | 6 76 | 6 3 | 6 37 | 7 22 | NA | NA | NA | 4 81 |
| Specific Conductance (uohms/cm) | 5 0 | 4150 | 2750 | 3680 | 3910 | 2060 | 2060 | 4080 | 4260 | 3820 | NA | NA | NA | 5 U |
| Sulfate | 0 1 | 3860 | 1320 | 1670 | 3400 | 977 | 980 | 2470 | 2850 | 1400 | NA | NA | NA | 0 1 U |
| Total dissolved solids | 10 | 5400 | 2360 | 3480 | 4370 | 1840 | 1870 | 4110 | 4420 | 2480 | NA | NA | NA | 10 U |
| Turbidity (NTU) | 0 2 | 46 | 99 | 4600 | 2300 | 23 | 18 2 | 80 5 | 86 | 1240 | NA | NA | NA | 0 2 U |

a/ U=undetected J=estimated concentration NA=not analyzed B=probable blank contamination
b/ duplicate of MW 11B
c/ trip blank sent with samples 9/22/97
d/ trip blank sent with samples 9/23/97
e/ trip blank sent with samples 9/24/97
f/ equipment blank collected 9/24/97
g/ CRQL = contract required quantitation limit (organics) IDL = instrument detection limit (metals)
MRL = method reporting level (inorganics)

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Appendix D – Quality Assurance/Quality Control Report

ENVIRONMENTAL STRATEGIES CORPORATION
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# DATA VALIDATION SUMMARY REPORT
# 1997 INTERIM GROUNDWATER MONITORING
# BUCKEYE RECLAMATION LANDFILL
# BELMONT COUNTY, OHIO

**PREPARED**

**BY**

**ENVIRONMENTAL STRATEGIES CORPORATION**

**JANUARY 16, 1998**

## Contents



**List of Tables**



**List of Attachments**

## Introduction

This data validation review includes analytical data from nine groundwater samples and associated field and laboratory quality control (QC) samples collected by Environmental Strategies Corporation (ESC) at the Buckeye Reclamation Landfill Site in Belmont County Ohio, on September 22, 23 and 24 1997 The samples were analyzed by Ceimic Corporation Narragansett Rhode Island for volatile organic compounds (VOCs) polyaromatic hydrocarbons (PAHs) and bis-(2-ethylhexyl)phthalate (B2EHP), total and dissolved metals and the inorganic parameters alkalinity ammonia nitrogen chemical oxygen demand, chloride, nitrate nitrite, pH, specific conductance, sulfate total dissolved solids and turbidity in accordance with Ohio EPA Solid Waste Regulations 3745-27-10 and regulatory agency requests The VOCs and PAHs and B2EHP were analyzed by U S Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Statement of Work (SOW) for Organics OLM01 9 The metals were analyzed by EPA CLP SOW for inorganics, ILM03 0 The inorganic parameters were analyzed by EPA Methods SM 2320B 350 1 410 4 9056 9056 9056 150 1 120 1 9056 160 1 and 180 1 respectively

This report presents a discussion of the data quality for each faction (i e VOCs PAHs and B2EHP metals and inorganics) The qualified analytical data are presented in Table A-1 A summary of the individual samples and the analyses conducted are presented in Table A-2 The QC data are presented in Tables A-2 through A-10 and the data qualifier definitions are presented in Attachments A and B Field QC and overall assessment of the analytical data are discussed in separate sections of this report

The analytical data were validated and qualified according to the EPA CLP National Functional Guidelines for Organic Data Review (EPA-540/R 94/012, February 1994) EPA CLP National Functional Guidelines for Inorganic Data Review (EPA-540/R-94/013 February 1994) EPA Region V Standard Operating Procedure for Validation of CLP Organic Data (August 1993) and method specific criteria

The VOCs, PAHs and B2EHP data were reviewed for holding times from date of sample collection surrogate recoveries matrix spike/matrix spike duplicate (MS/MSD) method equipment and trip blanks (VOCS only) instrument performance (GC/MS tune), initial and

continuing calibration, internal standard performance, chromatographic and mass spectral raw data, field duplicates, and overall assessment of the VOC and PAH/B2EHP data

The metals data were reviewed for holding times from date of sample collection calibration blanks, interference check sample (ICS), laboratory control sample (LCS) matrix spike laboratory duplicate, post digestion spike recovery ICP serial dilution preparation and analysis logs, CRDLs instrument raw data field duplicate and overall assessment of the inorganic data

The inorganic parameters were reviewed for holding times from date of sample collection, calibration blanks LCS, MS/MSD, laboratory duplicate preparation and analysis logs detection limits instrument raw data field duplicate and overall assessment of the inorganic data

**VOCs**

All samples were analyzed within the required method holding times Holding times are presented in Table A-3 The relative percent difference (RPD) between the MS and MSD was outside of recommended QC limits No action was taken on the data because analytical data are not qualified based on MS/MSD alone MS/MSD outside of QC limits are presented in Table A-5 Acetone and 2-butanone were detected in the laboratory blank corresponding to samples MW-16C MW-17C P-1B and P 22 Positive results for these compounds in these samples were considered undetected as probable blank contamination (B) Laboratory blank contamination is presented in Table A-6 Methylene chloride and acetone were detected in the equipment blank (FB092497) and the trip blank sent on 9/23/97 (TB092397) Methylene chloride acetone and 2-butanone were detected in the trip blanks sent on 9/22/97 (TB092297) and 9/24/97 (TB092497) Positive results for these compounds in the corresponding samples were considered undetected as probable blank contamination (B) Equipment and trip blank contamination are presented in Table A-7 All other QC criteria including GC/MS tune initial and continuing calibration internal standard performance chromatographic and mass spectral raw data were within acceptable limits

**SVOCs**

The samples were extracted and analyzed within the required method holding times Holding times are presented in Table A-3 The surrogate terpheyl-d14 in sample MW-17C was outside of QC limits (Table A-4) No action was taken on the data Data are qualified if two or more acid or base neutral surrogates are outside of QC limits Surrogates outside of QC limits are presented in Table A-4 All internal standards except pyrylene-d12 were outside of QC limits in MW-17C MS and MW-17C MSD No action was taken on the data because these samples were the matrix spikes The unspiked MW-17C was within acceptable limits Internal standards outside of QC limits are presented in Table A-8 All other QC criteria including MS/MSD, method equipment and trip blanks (VOCS only), instrument performance (GC/MS tune) initial and continuing calibration internal standard performance chromatographic and mass spectral raw data were within acceptable limits

**Total and Dissolved Metals**

The dissolved metals were filtered in the field using 0 45 micron filters The samples were prepared and analyzed within the required method holding times Holding times are presented in Table A-3 The matrix spike for total antimony and total and dissolved lead were outside of QC limits A post digestion spike was run that was within acceptable QC limits This indicates that the MS was outside of QC limits due to matrix interference The RPD between the laboratory duplicate pair was outside of QC limits for total and dissolved lead and dissolved chromium and magnesium ICP serial dilutions were outside of QC limits for total lead and dissolved calcium and dissolved magnesium Results for these analytes were considered estimated concentrations (J/UJ) Matrix spike laboratory duplicates and ICP serial dilutions outside of QC limits are presented in Table A-9 Calcium, iron, lead, manganese, sodium and zinc were detected in the equipment blank at low levels Results for these analytes in the corresponding samples were considered undetected as probable blank contamination if the concentration of these analytes in the sample was less than five times the concentration of the same analytes in the blank All other QC criteria including calibration blanks, ICS LCS post digestion spike recovery preparation and analysis logs CRDLs instrument raw data were within acceptable limits

**Inorganic Analytes**

All samples were analyzed within the required method holding times Holding times are presented in Table A-3 Alkalinity was detected in the equipment blank No action was taken on the data because the alkalinity concentration in the corresponding samples was greater than five times the level in the blank All QC criteria including calibration blanks LCS MS/MSD laboratory duplicate preparation and analysis logs detection limits and instrument raw data were within acceptable limits

**Field Quality Control**

Three trip blanks were analyzed for VOCs to assess cross contamination during sample transit from the field to the laboratory Methylene chloride and acetone were detected in TB092397 Methylene chloride, acetone and 2-butanone were detected in TB092297 and TB092497 (Table A-7) Results for these compounds were considered undetected as probable blank contamination

One equipment blank (FB092497) was collected for the same parameters as the samples to assess the efficiency of the decontamination process Several analytes were detected in the equipment blank The corresponding sample results for these analytes were qualified as undetected probable blank contamination (UB) if the concentration in the sample was less than five times (10 times for methylene chloride and acetone) the concentration detected in the blank Equipment blank contamination is presented on Table A-7

One blind field duplicate was collected with these samples MW-60 was a blind field duplicate of MW-11B Analytes detected in both samples and the calculated RPDs are presented on table A-10

RPDs of 30 or less indicate excellent field and laboratory precision and a homogeneous sample matrix

**Overall Assessment of the Data**

All samples were analyzed within the required method holding times Methylene chloride acetone and 2-butanone which are common laboratory contaminants were detected in the equipment and trip blanks Several metals at trace levels were also detected in the equipment blank The effect on the data was discussed above Matrix spike recoveries laboratory duplicate

precision, and ICP serial dilutions were outside of QC limits for several metals Therefore results in the corresponding water quality samples were considered estimated Based on the QA/QC review, the analytical data, with qualification are of acceptable quality and usable for the purpose of assessing analyte concentrations in groundwater at this site

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Attachment A - Data Qualifier Definitions for Inorganic Data Review

U - The analyte was analyzed for but not detected above the level of the associated value The associated value is the Instrument Detection Limit (IDL) for all analytes

J - The analyte was analyzed for and was positively identified but the associated numerical value may not be consistent with the amount actually present in the environmental sample

One or more of the following quality control criteria were not met

- Blank contamination indicates possible high bias and/or false positives
- Calibration range exceeded indicates possible low bias and/or false negatives
- Holding times not met indicates possible low bias and/or false negatives
- Other QC outside control limits bias not readily determined

UJ A combination of the U and J qualifiers The analyte was analyzed for but was not detected above the level of the associated value The associated value may not accurately or precisely represent the sample detection limit

UB The result is considered undetected because of probable blank contamination

Reference U S EPA CLP Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis (February 1994)

Attachment B - Data Qualifier Definitions for Organic Data Review

The following definitions provide brief explanations of the national qualifiers assigned to results in the data review process

U — The analyte was analyzed for but was not detected above the reported sample quantitation limit

J — The analyte was positively identified the associated numerical value is the approximate concentration of the analyte in the sample

UJ — The analyte was not detected above the reported sample quantitation limit However the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample

UB — The result is considered undetected because of probable blank contamination

Reference U S EPA CLP National Functional Guidelines for Organic Data Review (February 1994)

**Table A 1**

**Groundwater Sampling Results**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio (ug/l)(a)**
**September 22 24, 1997**

| Compound | P 1B | P 2 | P 4 | P 22 | MW 11B | MW 60 (b) | MW 15C | MW 16C | MW 17C | TB092297 (c) | TB092397 (d) | TB092497 (e) | FB092497 (f) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOCs** | | | | | | | | | | | | | |
| Chloromethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromomethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Vinyl Chloride | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chloroethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Methylene Chloride | 5 BJ | 4 BJ | 4 BJ | 3 BJ | 4 BJ | 5 B | 4 BJ | 5 BJ | 4 BJ | 11 | 9 | 4 J | 4 J |
| Acetone | 5 BJ | 3 BJ | 16 BJ | 5 BJ | 4 BJ | 3 BJ | 2 BJ | 3 BJ | 2 BJ | 3 J | 2 J | 3 J | 3 J |
| Carbon Disulfide | 1 J | 5 U | 5 U | 1 J | 2 J | 2 J | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 Dichloroethene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 Dichloroethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| cis 1 2 Dichloroethene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| trans 1 2 Dichloroethene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromochloromethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chloroform | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dichloroethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 2 Butanone | 2 BJ | 10 U | 10 U | 10 U | 10 U | 10 U | 1 BJ | 10 U | 1 BJ | 4 J | 10 U | 1 J | 1 J |
| 1 1 1 Trichloroethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Carbon Tetrachloride | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Vinyl Acetate | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dichloropropane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| cis 1 3 Dichloropropene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichloroethene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Dibromochloromethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 2 Trichloroethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Bromoform | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dibromo-3 chloropropane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 4 Methyl 2 Pentanone | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2 Hexanone | 1 J | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 1 J | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 2 2 Tetrachloroethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Toluene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Chlorobenzene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Styrene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Xylene (total) | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 4 Dichlorobenzene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dichlorobenzene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Iodomethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Acrylonitrile | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U | 20 U |
| Dibromomethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 Dibromomethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 1 1 2 Tetrachloroethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| 1 2 3 Trichloropropane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| trans 1 4 Dichloro 2 butene | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |
| Trichlorofluoromethane | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U | 5 U |

**Table A 1 (continued)**

**Groundwater Sampling Results**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio (ug/l)(a)**
**September 22 24, 1997**

| Compound | P 1B | P 2 | P-4 | P 22 | MW 11B | MW-60 (b) | MW 15C | MW 16C | MW 17C | TB092297 (c) | TB092397 (d) | TB092497 (e) | FB092497 (f) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SVOCs** | | | | | | | | | | | | | |
| Naphthalene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| 2 Methylnaphthalene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| 2 Chloronaphthalene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Acenaphthylene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Acenaphthene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Dibenzofuran | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Fluorene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Phenanthrene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Anthracene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Fluoranthene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Pyrene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(a)anthracene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Chrysene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(b)fluoranthene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(k)fluoranthene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(a)pyrene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Indeno(1 2 3 cd)pyrene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Dibenzo(a,h)anthracene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Benzo(g h i)perylene | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U | NA | NA | NA | 10 U |
| Bis(2-ethylhexyl)phthalate | 3 J | 10 U | 1 J | 10 U | 10 U | 10 U | 2 J | 4 J | 3 J | NA | NA | NA | 10 U |
| **Analyte** | | | | | | | | | | | | | |
| **Total Metals (ug/l)** | | | | | | | | | | | | | |
| Antimony | 1 7 UJ | 1 7 UJ | 1 8 UJ | 2 8 J | 2 7 J | 1 7 UJ | 1 7 UJ | 1 7 UJ | 1 7 UJ | NA | NA | NA | 1 7 UJ |
| Arsenic | 65 6 | 3 2 U | 143 | 74 5 | 3 2 U | 3 2 U | 3 2 U | 3 2 U | 26 7 | NA | NA | NA | 3 2 U |
| Barium | 37 6 J | 28 8 J | 979 | 141 J | 21 3 J | 15 6 J | 45 8 J | 31 6 J | 623 | NA | NA | NA | 2 4 U |
| Beryllium | 9 3 | 0 3 U | 4 7 J | 4 5 J | 0 72 J | 0 3 U | 0 87 J | 0 3 U | 1 9 J | NA | NA | NA | 0 3 U |
| Cadmium | 2 U | 0 49 U | 1 3 J | 2 U | 0 54 J | 0 57 J | 0 51 J | 0 4 U | 2 4 J | NA | NA | NA | 0 4 U |
| Calcium | 377000 | 382000 | 616000 | 378000 | 321000 | 319000 | 378000 | 444000 | 75700 | NA | NA | NA | 1440 J |
| Chromium | 19 6 | 6 5 U | 121 | 40 9 | 6 5 U | 6 5 U | 7 6 J | 6 5 U | 43 4 | NA | NA | NA | 6 5 U |
| Cobalt | 88 6 | 7 U | 611 | 65 4 | 11 8 J | 16 3 J | 7 U | 12 7 J | 14 3 J | NA | NA | NA | 7 U |
| Copper | 10 7 J | 3 8 U | 168 | 143 | 3 8 U | 3 8 U | 3 8 U | 3 8 U | 43 8 | NA | NA | NA | 3 8 U |
| Iron | 595000 | 1590 | 157000 | 819000 | 2020 | 2090 | 10900 | 9500 | 22800 | NA | NA | NA | 254 |
| Lead | 21 3 J | 4 4 J | 102 J | 146 J | 1 5 J | 3 2 J | 3 5 J | 1 3 UJ | 74 J | NA | NA | NA | 1 8 J |
| Magnesium | 59400 | 112000 | 172000 | 79400 | 73800 | 71900 | 234000 | 257000 | 27500 | NA | NA | NA | 91 8 J |
| Manganese | 2630 | 724 | 7380 | 3850 | 897 | 893 | 331 | 290 | 185 | NA | NA | NA | 6 4 J |
| Nickel | 370 | 10 7 J | 1070 | 203 | 21 5 J | 24 7 J | 7 9 U | 41 6 | 52 9 | NA | NA | NA | 7 9 U |
| Potassium | 16700 | 1240 J | 24200 | 16200 | 5980 | 4770 J | 7810 | 7400 | 10900 | NA | NA | NA | 157 U |
| Selenium | 66 U | 3 3 U | 3 3 U | 33 U | 3 3 U | 3 3 U | 3 3 U | 3 3 U | 16 9 | NA | NA | NA | 3 3 U |
| Silver | 3 6 J | 1 1 U | 1 6 J | 5 5 J | 1 6 J | 1 2 J | 1 6 J | 1 1 U | 3 8 | NA | NA | NA | 1 1 U |
| Sodium | 122000 J | 124000 J | 221000 J | 106000 J | 74700 J | 72000 J | 288000 J | 232000 J | 610000 J | NA | NA | NA | 948 J |
| Thallium | 1 5 U | 3 5 J | 12 7 | 1 5 U | 3 8 J | 3 7 J | 1 9 J | 2 J | 3 3 J | NA | NA | NA | 1 5 U |
| Vanadium | 57 3 | 5 3 U | 108 | 40 5 J | 5 3 U | 5 3 U | 5 3 U | 5 3 U | 62 4 | NA | NA | NA | 5 3 U |
| Zinc | 1560 | 17 9 J | 697 | 847 | 14 7 J | 10 4 J | 12 6 J | 20 7 | 65 8 | NA | NA | NA | 6 5 J |

| Analyte | P 1B | P 2 | P 4 | P 22 | MW 11B | MW 60 (b) | MW 15C | MW 16C | MW 17C | TB092297 | TB092397 | TB092497 | FB092497 (c) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dissolved Metals (ug/l)** | | | | | | | | | | | | | |
| Antimony | 3 J | 1 7 U | 1 7 U | 3 3 J | 1 7 U | 1 7 U | 1 9 J | 1 7 U | 1 7 U | NA | NA | NA | 1 7 U |
| Arsenic | 52 8 | 3 2 U | 26 8 | 47 7 | 3 2 U | 3 2 U | 3 2 U | 3 2 U | 3 2 U | NA | NA | NA | 3 2 U |
| Barium | 12 1 J | 20 8 J | 19 7 J | 48 U | 9 2 B | 10 5 J | 7 6 J | 11 9 J | 18 3 J | NA | NA | NA | 2 4 U |
| Beryllium | 8 6 | 1 7 J | 0 3 U | 6 U | 0 3 U | 0 3 U | 0 43 J | 0 43 J | 0 3 U | NA | NA | NA | 0 3 U |
| Cadmium | 8 U | 0 64 J | 0 4 U | 8 U | 0 4 U | 0 4 U | 0 4 U | 0 4 U | 5 7 | NA | NA | NA | 0 4 U |
| Calcium | 348000 J | 352000 J | 445000 J | 426000 J | 283000 J | 302000 J | 343000 J | 436000 J | 64700 J | NA | NA | NA | 1960 J |
| Chromium | 18 3 J | 19 4 J | 6 5 UJ | 130 UJ | 6 5 UJ | 6 5 UJ | 6 5 UJ | 6 5 J | 6 5 UJ | NA | NA | NA | 6 5 UJ |
| Cobalt | 84 5 | 7 U | 14 7 J | 140 U | 11 J | 18 J | 7 U | 7 U | 7 U | NA | NA | NA | 7 U |
| Copper | 4 8 J | 3 8 U | 3 8 U | 76 U | 5 9 J | 18 7 J | 9 1 J | 3 8 U | 5 8 J | NA | NA | NA | 3 8 U |
| Iron | 546000 | 63 3 J | 21400 | 644000 | 2800 | 1430 | 8630 | 3650 J | 101 | NA | NA | NA | 164 |
| Lead | 20 1 J | 2 5 J | 4 3 J | 25 2 J | 1 3 UJ | 1 3 J | 1 3 J | 1 3 J | 69 5 J | NA | NA | NA | 1 7 J |
| Magnesium | 55600 J | 99700 J | 151000 J | 87800 J | 65300 J | 68100 J | 207000 J | 256000 J | 21600 J | NA | NA | NA | 84 4 UJ |
| Manganese | 2470 | 472 | 5920 | 4280 | 677 | 713 | 321 | 265 | 78 2 | NA | NA | NA | 6 4 J |
| Nickel | 354 | 9 9 J | 71 | 193 J | 14 5 J | 28 5 U | 8 3 J | 32 2 J | 7 9 U | NA | NA | NA | 7 9 U |
| Potassium | 15000 | 1350 J | 3110 J | 12700 | 4000 J | 3910 U | 6260 | 7030 | 3720 J | NA | NA | NA | 157 U |
| Selenium | 66 U | 3 3 U | 3 3 U | 66 U | 3 3 U | 3 3 U | 3 3 U | 3 3 U | 3 3 U | NA | NA | NA | 3 3 U |
| Silver | 3 5 J | 1 1 U | 1 1 U | 5 5 J | 1 1 U | 1 1 U | 1 1 U | 1 1 U | 2 7 J | NA | NA | NA | 1 1 U |
| Sodium | 114000 | 114000 | 240000 | 120000 | 66700 | 69100 | 261000 | 231000 | 738000 | NA | NA | NA | 1300 J |
| Thallium | 8 9 J | 1 5 U | 3 5 J | 3 4 J | 1 9 U | 1 7 J | 2 1 J | 2 1 J | 1 5 U | NA | NA | NA | 1 5 U |
| Vanadium | 61 3 | 5 3 U | 5 3 U | 106 U | 5 3 U | 12 9 J | 7 4 J | 5 3 U | 5 3 U | NA | NA | NA | 5 3 U |
| Zinc | 1490 | 8 J | 12 J | 1500 | 9 2 J | 16 2 J | 10 J | 14 5 J | 12 3 J | NA | NA | NA | 57 1 |
| **Other Analytical Parameters (mg/l)** | | | | | | | | | | | | | |
| Alkalinity | 2 U | 696 | 1080 | 2 U | 402 | 406 | 698 | 776 | 868 | NA | NA | NA | 2 3 |
| Ammonia nitrogen | 3 71 | 0 11 | 1 1 | 3 99 | 0 45 | 0 39 | 1 98 | 1 63 | 2 47 | NA | NA | NA | 0 1 U |
| Chemical oxygen demand | 111 | 15 6 | 850 | 25 | 5 U | 7 2 | 5 U | 30 | 1330 | NA | NA | NA | 9 1 |
| Chloride | 85 8 | 92 3 | 217 | 23 3 | 71 3 | 74 3 | 108 | 120 | 68 9 | NA | NA | NA | 0 1 U |
| Nitrate nitrogen | 0 1 U | 0 1 | 0 11 | 0 1 U | 0 1 U | 0 1 U | 0 1 U | 0 1 U | 2 08 | NA | NA | NA | 0 1 U |
| Nitrite nitrogen | 0 1 U | 0 1 | 0 1 U | 0 067 J | 0 1 U | 0 1 U | 0 1 U | 0 1 U | 0 1 U | NA | NA | NA | 0 1 U |
| pH (units) | 3 47 | 6 23 | 6 41 | 4 6 | 6 67 | 6 76 | 6 3 | 6 37 | 7 22 | NA | NA | NA | 4 81 |
| Specific Conductance (uohms/cm) | 4150 | 2750 | 3680 | 3910 | 2060 | 2060 | 4080 | 4260 | 3820 | NA | NA | NA | 5 U |
| Sulfate | 3860 | 1320 | 1670 | 3400 | 977 | 980 | 2470 | 2850 | 1400 | NA | NA | NA | 0 1 U |
| Total dissolved solids | 5400 | 2360 | 3480 | 4370 | 1840 | 1870 | 4110 | 4420 | 2480 | NA | NA | NA | 10 U |
| Turbidity (NTU) | 46 | 99 | 4600 | 2300 | 23 | 18 2 | 80 5 | 86 | 1240 | NA | NA | NA | 0 2 U |

a/ U=undetected J=estimated concentration NA=not analyzed B=probable blank contamination
b/ duplicate of MW 11B
c/ trip blank sent with samples 9/22/97
d/ trip blank sent with samples 9/23/97
e/ trip blank sent with samples 9/24/97
f/ equipment blank collected 9/24/97

**Table A-2**

**Samples Collected at the Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22 - 24, 1997**

| Sample | Date Collected | Matrix | Fraction |
|---|---|---|---|
| MW 11B | 09/22/97 | water | VOCs PAHs&B2EHP TMet, DMet,NH4 COD Alk. TDS NO3 SO4 Cl, pH,Turb Sp Cond. |
| MW-60 | 09/22/97 | water | VOCs PAHs&B2EHP TMet, DMet,NH4 COD Alk. TDS NO3 SO4 Cl, pH,Turb Sp Cond |
| P-4 | 09/22/97 | water | VOCs, PAHs&B2EHP TMet, DMet,NH4 COD Alk. TDS NO3 SO4 Cl, pH,Turb Sp Cond |
| TB092297 | 09/22/97 | water | VOCs |
| P 2 | 09/23/97 | water | VOCs, PAHs&B2EHP TMet, DMet,NH4 COD Alk. TDS NO3 SO4 Cl, pH,Turb Sp Cond |
| MW 15C | 09/23/97 | water | VOCs, PAHs&B2EHP TMet, DMet,NH4 COD Alk. TDS NO3 SO4 Cl pH,Turb Sp Cond |
| MW 17C | 09/23/97 | water | VOCs PAHs&B2EHP TMet, DMet NH4 COD Alk TDS NO3 SO4 Cl pH,Turb Sp Cond |
| P 22 | 09/23/97 | water | VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl, pH,Turb Sp Cond |
| MW 16C | 09/23/97 | water | VOCs PAHs&B2EHP TMet DMet,NH4 COD Alk TDS NO3 SO4 Cl pH,Turb Sp Cond |
| TB092397 | 09/23/97 | water | VOCs |
| P 1B | 09/24/97 | water | VOCs PAHs&B2EHP TMet, DMet,NH4 COD Alk TDS NO3 SO4 Cl pH,Turb Sp Cond. |
| FB092497 | 09/24/97 | water | VOCs PAHs&B2EHP TMet, DMet,NH4 COD Alk TDS NO3 SO4 Cl, pH,Turb Sp Cond. |
| TB092497 | 09/24/97 | water | VOCs |

**Table A 3**

**Analytical Holding Times for Samples Collected at the**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio(a)**
**September 22-24-1997**

| Sample | Date Collected | Matrix | Date Analyzed | No of Days to Analyze | Holding Time (days) |
|---|---|---|---|---|---|
| **VOCS** | | | | | |
| MW 11B | 09/22/97 | Water | 09/30/97 | 8 | 14 |
| MW 60 | 09/22/97 | Water | 09/30/97 | 8 | 14 |
| P-4 | 09/22/97 | Water | 10/01/97 | 9 | 14 |
| TB092297 | 09/22/97 | Water | 09/30/97 | 8 | 14 |
| P 2 | 09/23/97 | Water | 10/01/97 | 8 | 14 |
| MW 15C | 09/23/97 | Water | 09/30/97 | 7 | 14 |
| MW 17C | 09/23/97 | Water | 10/01/97 | 8 | 14 |
| P 22 | 09/23/97 | Water | 10/01/97 | 8 | 14 |
| MW 16C | 09/23/97 | Water | 10/01/97 | 8 | 14 |
| TB092397 | 09/23/97 | Water | 09/30/97 | 7 | 14 |
| P 1B | 09/24/97 | Water | 10/01/97 | 7 | 14 |
| FB092497 | 09/24/97 | Water | 09/30/97 | 6 | 14 |
| TB092497 | 09/24/97 | Water | 09/30/97 | 6 | 14 |

| Sample | Date Collected | Date Extracted | Date Analyzed | Days to Extract | Days to Analyze | Holding Time (days) |
|---|---|---|---|---|---|---|
| **SVOCs** | | | | | | |
| MW 11B | 09/22/97 | 09/26/97 | 10/10/97 | 4 | 14 | 7 to extr /40 to analyze |
| MW 60 | 09/22/97 | 09/26/97 | 10/10/97 | 4 | 14 | 7 to extr /40 to analyze |
| P-4 | 09/22/97 | 09/26/97 | 10/10/97 | 4 | 14 | 7 to extr /40 to analyze |
| TB092297 | 09/22/97 | NA | NA | NA | NA | 7 to extr /40 to analyze |
| P 2 | 09/23/97 | 09/26/97 | 10/10/97 | 3 | 14 | 7 to extr /40 to analyze |
| MW 15C | 09/23/97 | 09/26/97 | 10/10/97 | 3 | 14 | 7 to extr /40 to analyze |
| MW 17C | 09/23/97 | 09/26/97 | 10/10/97 | 3 | 14 | 7 to extr /40 to analyze |
| P 22 | 09/23/97 | 09/26/97 | 10/12/97 | 3 | 16 | 7 to extr /40 to analyze |
| MW 16C | 09/23/97 | 09/26/97 | 10/12/97 | 3 | 16 | 7 to extr /40 to analyze |
| TB092397 | 09/23/97 | NA | NA | NA | NA | 7 to extr /40 to analyze |
| P 1B | 09/24/97 | 09/26/97 | 10/10/97 | 2 | 14 | 7 to extr /40 to analyze |
| FB092497 | 09/24/97 | 09/26/97 | 10/10/97 | 2 | 14 | 7 to extr /40 to analyze |
| TB092497 | 09/24/97 | 07/14/96 | 07/16/96 | 437 | 2 | 7 to extr /40 to analyze |

**Table A 3 (continued)**

**Analytical Holding Times for Samples Collected at the**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio(a)**
**September 22 24, 1997**

| Sample | Date Collected | Date Analyzed | Days to Analyze | Holding Time (days) |
|---|---|---|---|---|
| **Total and Dissolved Metals** | | | | |
| MW 11B | 09/22/97 | 10/18/97 | 26 | 28 |
| MW-60 | 09/22/97 | 10/18/97 | 26 | 28 |
| P-4 | 09/22/97 | 10/18/97 | 26 | 28 |
| TB092297 | 09/22/97 | NA | NA | 28 |
| P 2 | 09/23/97 | 10/18/97 | 25 | 28 |
| MW 15C | 09/23/97 | 10/18/97 | 25 | 28 |
| MW 17C | 09/23/97 | 10/18/97 | 25 | 28 |
| P 22 | 09/23/97 | 10/18/97 | NA | 28 |
| MW 16C | 09/23/97 | 10/18/97 | 25 | 28 |
| TB092397 | 09/23/97 | NA | NA | 28 |
| P 1B | 09/24/97 | 10/18/97 | 24 | 28 |
| FB092497 | 09/24/97 | 10/18/97 | 24 | 28 |
| TB092497 | 09/24/97 | NA | NA | 28 |
| **Alkalinity** | | | | |
| MW 11B | 09/22/97 | 10/06/97 | 14 | 14 |
| MW 60 | 09/22/97 | 10/06/97 | 14 | 14 |
| P-4 | 09/22/97 | 10/06/97 | 14 | 14 |
| TB092297 | 09/22/97 | NA | NA | 14 |
| P 2 | 09/23/97 | 10/06/97 | 13 | 14 |
| MW 15C | 09/23/97 | 10/06/97 | 13 | 14 |
| MW 17C | 09/23/97 | 10/06/97 | 13 | 14 |
| P 22 | 09/23/97 | 10/06/97 | 13 | 14 |
| MW 16C | 09/23/97 | 10/06/97 | 13 | 14 |
| TB092397 | 09/23/97 | NA | NA | 14 |
| P 1B | 09/24/97 | 10/06/97 | 12 | 14 |
| FB092497 | 09/24/97 | 10/06/97 | 12 | 14 |
| TB092497 | 09/24/97 | NA | NA | 14 |

**Table A 3 (continued)**

**Analytical Holding Times for Samples Collected at the**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio(a)**
**September 22 24, 1997**

| Sample | Date Collected | Date Analyzed | Days to Analyze | Holding Time (days) |
|---|---|---|---|---|
| **Ammonia** | | | | |
| MW 11B | 09/22/97 | 10/09/97 | 17 | 28 |
| MW 60 | 09/22/97 | 10/09/97 | NA | 28 |
| P-4 | 09/22/97 | 10/09/97 | 17 | 28 |
| TB092297 | 09/22/97 | NA | NA | 28 |
| P 2 | 09/23/97 | 10/09/97 | 16 | 28 |
| MW 15C | 09/23/97 | 10/09/97 | 16 | 28 |
| MW 17C | 09/23/97 | 10/09/97 | 16 | 28 |
| P 22 | 09/23/97 | 10/09/97 | 16 | 28 |
| MW 16C | 09/23/97 | 10/09/97 | 16 | 28 |
| TB092397 | 09/23/97 | NA | NA | 28 |
| P 1B | 09/24/97 | 10/09/97 | 15 | 28 |
| FB092497 | 09/24/97 | 10/09/97 | 15 | 28 |
| TB092497 | 09/24/97 | NA | NA | 28 |
| **COD** | | | | |
| MW 11B | 09/22/97 | 10/10/97 | 18 | 28 |
| MW 60 | 09/22/97 | 10/10/97 | 18 | 28 |
| P-4 | 09/22/97 | 10/10/97 | 18 | 28 |
| TB092297 | 09/22/97 | NA | NA | 28 |
| P 2 | 09/23/97 | 10/10/97 | 17 | 28 |
| MW 15C | 09/23/97 | 10/10/97 | 17 | 28 |
| MW 17C | 09/23/97 | 10/13/97 | 20 | 28 |
| P 22 | 09/23/97 | 10/10/97 | 17 | 28 |
| MW 16C | 09/23/97 | 10/10/97 | 17 | 28 |
| TB092397 | 09/23/97 | NA | NA | 28 |
| P 1B | 09/24/97 | 10/10/97 | 16 | 28 |
| FB092497 | 09/24/97 | 10/10/97 | 16 | 28 |
| TB092497 | 09/24/97 | NA | NA | 28 |

**Table A 3 (continued)**

**Analytical Holding Times for Samples Collected at the**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio(a)**
**September 22 24, 1997**

| Sample | Date Collected | Date Analyzed | Days to Analyze | Holding Time (days) |
|---|---|---|---|---|
| **Chloride** | | | | |
| MW 11B | 09/22/97 | 09/24/97 | 2 | 28 |
| MW 60 | 09/22/97 | 09/24/97 | 2 | 28 |
| P 4 | 09/22/97 | 09/24/97 | 2 | 28 |
| TB092297 | 09/22/97 | NA | NA | 28 |
| P 2 | 09/23/97 | 09/25/97 | 2 | 28 |
| MW 15C | 09/23/97 | 09/25/97 | 2 | 28 |
| MW 17C | 09/23/97 | 09/27/97 | 4 | 28 |
| P 22 | 09/23/97 | 09/25/97 | 2 | 28 |
| MW 16C | 09/23/97 | 09/25/97 | 2 | 28 |
| TB092397 | 09/23/97 | NA | NA | 28 |
| P 1B | 09/24/97 | 09/27/97 | 3 | 28 |
| FB092497 | 09/24/97 | 09/27/97 | 3 | 28 |
| TB092497 | 09/24/97 | NA | NA | 28 |
| **Nitrate** | | | | |
| MW 11B | 09/22/97 | 09/23/97 | 1 | 2 |
| MW 60 | 09/22/97 | 09/23/97 | 1 | 2 |
| P-4 | 09/22/97 | 09/23/97 | 1 | 2 |
| TB092297 | 09/22/97 | NA | NA | 2 |
| P 2 | 09/23/97 | 09/25/97 | 2 | 2 |
| MW 15C | 09/23/97 | 09/25/97 | 2 | 2 |
| MW 17C | 09/23/97 | 09/25/97 | 2 | 2 |
| P 22 | 09/23/97 | 09/25/97 | 2 | 2 |
| MW 16C | 09/23/97 | 09/25/97 | 2 | 2 |
| TB092397 | 09/23/97 | NA | NA | 2 |
| P 1B | 09/24/97 | 09/27/97 | 3 | 2 |
| FB092497 | 09/24/97 | 09/27/97 | 3 | 2 |
| TB092497 | 09/24/97 | NA | NA | 2 |

**Table A 3 (continued)**

**Analytical Holding Times for Samples Collected at the Buckeye Reclamation Landfill Belmont County, Ohio(a) September 22 24, 1997**

| Sample | Date Collected | Date Analyzed | Days to Analyze | Holding Time (days) |
|---|---|---|---|---|
| **Nitrite** | | | | |
| MW 11B | 09/22/97 | 09/23/97 | 1 | 2 |
| MW 60 | 09/22/97 | 09/23/97 | 1 | 2 |
| P 4 | 09/22/97 | 09/23/97 | 1 | 2 |
| TB092297 | 09/22/97 | NA | NA | 2 |
| P 2 | 09/23/97 | 09/25/97 | 2 | 2 |
| MW 15C | 09/23/97 | 09/25/97 | 2 | 2 |
| MW 17C | 09/23/97 | 09/25/97 | 2 | 2 |
| P 22 | 09/23/97 | 09/25/97 | 2 | 2 |
| MW 16C | 09/23/97 | 09/25/97 | 2 | 2 |
| TB092397 | 09/23/97 | NA | NA | 2 |
| P 1B | 09/24/97 | 09/27/97 | 3 | 2 |
| FB092497 | 09/24/97 | 09/27/97 | 3 | 2 |
| TB092497 | 09/24/97 | NA | NA | 2 |
| **pH** | | | | |
| MW 11B | 09/22/97 | 09/23/97 | 1 | 1 |
| MW 60 | 09/22/97 | 09/23/97 | 1 | 1 |
| P 4 | 09/22/97 | 09/23/97 | 1 | 1 |
| TB092297 | 09/22/97 | NA | NA | 1 |
| P 2 | 09/23/97 | 09/24/97 | 1 | 1 |
| MW 15C | 09/23/97 | 09/24/97 | 1 | 1 |
| MW 17C | 09/23/97 | 09/24/97 | 1 | 1 |
| P 22 | 09/23/97 | 09/24/97 | 1 | 1 |
| MW 16C | 09/23/97 | 09/24/97 | 1 | 1 |
| TB092397 | 09/23/97 | NA | NA | 1 |
| P 1B | 09/24/97 | 09/25/97 | 1 | 1 |
| FB092497 | 09/24/97 | 09/25/97 | 1 | 1 |
| TB092497 | 09/24/97 | NA | NA | 1 |

**Table A 3 (continued)**

**Analytical Holding Times for Samples Collected at the Buckeye Reclamation Landfill Belmont County, Ohio(a) September 22-24, 1997**

| Sample | Date Collected | Date Analyzed | Days to Analyze | Holding Time (days) |
|---|---|---|---|---|
| **Specific Conductance** | | | | |
| MW 11B | 09/22/97 | 10/09/97 | 17 | 28 |
| MW 60 | 09/22/97 | 10/09/97 | 17 | 28 |
| P-4 | 09/22/97 | 10/09/97 | 17 | 28 |
| TB092297 | 09/22/97 | NA | NA | 28 |
| P 2 | 09/23/97 | 10/09/97 | 16 | 28 |
| MW 15C | 09/23/97 | 10/09/97 | 16 | 28 |
| MW 17C | 09/23/97 | 10/09/97 | 16 | 28 |
| P 22 | 09/23/97 | 10/09/97 | 16 | 28 |
| MW 16C | 09/23/97 | 10/09/97 | 16 | 28 |
| TB092397 | 09/23/97 | NA | NA | 28 |
| P 1B | 09/24/97 | 10/09/97 | 15 | 28 |
| FB092497 | 09/24/97 | 10/09/97 | 15 | 28 |
| TB092497 | 09/24/97 | NA | NA | 28 |
| **Sulfate** | | | | |
| MW 11B | 09/22/97 | 09/24/97 | 2 | 28 |
| MW 60 | 09/22/97 | 09/24/97 | 2 | 28 |
| P 4 | 09/22/97 | 09/24/97 | 2 | 28 |
| TB092297 | 09/22/97 | NA | NA | 28 |
| P 2 | 09/23/97 | 09/25/97 | 2 | 28 |
| MW 15C | 09/23/97 | 09/25/97 | 2 | 28 |
| MW 17C | 09/23/97 | 09/27/97 | 4 | 28 |
| P 22 | 09/23/97 | 09/25/97 | 2 | 28 |
| MW 16C | 09/23/97 | 09/25/97 | 2 | 28 |
| TB092397 | 09/23/97 | NA | NA | 28 |
| P 1B | 09/24/97 | 09/27/97 | 3 | 28 |
| FB092497 | 09/24/97 | 09/27/97 | 3 | 28 |
| TB092497 | 09/24/97 | NA | NA | 28 |

**Table A 3 (continued)**

**Analytical Holding Times for Samples Collected at the Buckeye Reclamation Landfill Belmont County, Ohio(a) September 22 24, 1997**

| Sample | Date Collected | Date Analyzed | Days to Analyze | Holding Time (days) |
|---|---|---|---|---|
| **TDS** | | | | |
| MW 11B | 09/22/97 | 09/29/97 | 7 | 7 |
| MW 60 | 09/22/97 | 09/29/97 | 7 | 7 |
| P 4 | 09/22/97 | 09/29/97 | 7 | 7 |
| TB092297 | 09/22/97 | NA | NA | 7 |
| P 2 | 09/23/97 | 09/29/97 | 6 | 7 |
| MW 15C | 09/23/97 | 09/29/97 | 6 | 7 |
| MW 17C | 09/23/97 | 09/29/97 | 6 | 7 |
| P 22 | 09/23/97 | 09/29/97 | 6 | 7 |
| MW 16C | 09/23/97 | 09/29/97 | 6 | 7 |
| TB092397 | 09/23/97 | NA | NA | 7 |
| P 1B | 09/24/97 | 09/29/97 | 5 | 7 |
| FB092497 | 09/24/97 | 09/29/97 | 5 | 7 |
| TB092497 | 09/24/97 | NA | NA | 7 |
| **Turbidity** | | | | |
| MW 11B | 09/22/97 | 09/24/97 | 2 | 2 |
| MW 60 | 09/22/97 | 09/24/97 | 2 | 2 |
| P-4 | 09/22/97 | 09/24/97 | 2 | 2 |
| TB092297 | 09/22/97 | NA | NA | 2 |
| P 2 | 09/23/97 | 09/24/97 | 1 | 2 |
| MW 15C | 09/23/97 | 09/24/97 | 1 | 2 |
| MW 17C | 09/23/97 | 09/24/97 | 1 | 2 |
| P 22 | 09/23/97 | 09/24/97 | 1 | 2 |
| MW 16C | 09/23/97 | 09/24/97 | 1 | 2 |
| TB092397 | 09/23/97 | NA | NA | 2 |
| P 1B | 09/24/97 | 09/25/97 | 1 | 2 |
| FB092497 | 09/24/97 | 09/25/97 | 1 | 2 |
| TB092497 | 09/24/97 | NA | NA | 2 |

**Table A-4**

**Surrogate Recoveries Outside QC Limits**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22 24, 1997**

**SVOCs**

| Sample | NBZ (a) (35 114) (b) | FBP (a) (43-116) (b) | TPH (a) (33 141) (b) | PHL (a) (10-110) (b) | 2FP (a) (25 110) (b) | TBP (a) (10 123) (b) | 2CP (a) (33 110) (b) | DCB (a) (16-110) (b) |
|---|---|---|---|---|---|---|---|---|
| MW 17C | 72 | 70 | 24 (c) | 40 | 56 | 92 | 72 | 74 |

a/ NBZ=nitrobenzene-d5 FBP=2 fluorobiphenyl TPH=terphenyl-d14,PHL=Phenol d5
2FP=2 fluorophenol TBP=2 4 6-tribromophenol 2CP=2-chlorophenol d4 DCB=1 2 dichlorobenzene d4
b/ QC limits
c/ Outside of QC limits

**Table A 5**

**Matrix Spike/Matrix Spike Duplicate Results for Organics Analyses**
**Outside of Recommended QC Limits**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22 24, 1997 (a)**

**VOCs**

**Spiked Sample** **MW 17C**

| Compound | MS % Rec. | MSD % Rec. | MS/MSD QC Limits | RPD | RPD QC Limits |
|---|---|---|---|---|---|
| Acetone | 109 | 49 | 10 80 | 75 * | 50 |

a/ MS=matrix spike MSD=matrix spike duplicate RPD=relative percent difference
%Rec = percent recovery
b/ *=outside of QC limits

**Table A-6**

**Laboratory Blank Contamination**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22-24, 1997**

| Blank | Compound | Concentration (µg/l) | Associated Samples |
|---|---|---|---|
| VBLKHG | Acetone | 4 0 J | MW 16C MW 17C P 1B P 22 |
| | 2 Butanone | 1 J | |

**Table A 7**

**Equipment and Trip Blank Contamination**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22-24, 1997**

| Blank | Compound | Concentration (µg/l) | Associated Samples |
|---|---|---|---|
| FB092497 | Methylene chloride | 4 0 J | all |
| | Acetone | 3 J | |
| | Total Calcium | 1440 J | |
| | Total Iron | 254 | |
| | Total Lead | 1 8 J | |
| | Total Magnesium | 91 8 J | |
| | Total Manganese | 6 4 J | |
| | Total Sodium | 948 J | |
| | Total Zinc | 6 5 J | |
| | Dissolved Calcium | 1960 J | |
| | Dissolved Iron | 164 | |
| | Dissolved Lead | 1 7 J | |
| | Dissolved Manganese | 6 4 J | |
| | Dissolved Sodium | 1300 J | |
| | Dissolved Zinc | 57 1 | |
| | Alkalinity | 2 3 | |
| TB092297 | Methylene chloride | 11 | |
| | Acetone | 3 J | MW 11B MW 60 P 4 |
| | 2 Butanone | 4 J | |
| TB092397 | Methylene chloride | 9 | P 2 MW 15C MW 17C P 22 MW 16 |
| | Acetone | 2 J | |
| TB092497 | Methylene chloride | 4 J | |
| | Acetone | 3 0 J | |
| | 2 Butanone | 1 J | |

**Table A 8**

**Internal Standard Areas and Retention Times Outside of QC Limits**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio**
**September 22-24, 1997**

**SVOCs**

| Sample | DCB (a) | QC Limits | NPT (a) | QC Limits | ANT (a) | QC Limits |
|---|---|---|---|---|---|---|
| MW-17C MS | 17919 (b) | 25604-102414 | 62668 (b) | 95213 380852 | 39230 (b) | 56177-224708 |
| MW-17C MSD | 18597 (b) | 25604 102414 | 66476 (b) | 95213 380852 | 39994 (b) | 56177 224708 |

| Sample | PHN (a) | QC Limits | CRY (a) | QC Limits | PRY (a) | QC Limits |
|---|---|---|---|---|---|---|
| MW 17C MS | 78077 (b) | 106158-424630 | 73839 (b) | 85247 340988 | 89283 | 81532 326126 |
| MW-17C MSD | 82259 (b) | 106158-424630 | 71889 (b) | 85247 340988 | 89888 | 81532 326126 |

a/ DCB=1 4-dichlorobenzene-d4 NPT=naphthalene-d8 ANT=acenaphthene-d10
PHN=phenanthrene-d10 CRY=chrysene-d12 PYR=perylene-d12
b/ outside of QC limits

**Table A 9**

**Matrix Spike Recoveries, Laboratory Duplicate Precision and ICP Serial Dilutions for Metals Outside QC Limits**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio (a)**
**September 22 24 ,1997**

**Matrix Spike Recoveries**

**Spiked Sample MW 17C**

| Analyte | MS % Rec | Post Digestion Spike Recovery | QC Limits |
|---|---|---|---|
| Total Antimony | 46 4 (b) | 99 4 | 85 115 |
| Total Lead | 27 7 (b) | 89 3 | 85 115 |
| Dissolved Lead | 242 8 (b) | 87 7 | 85 115 |

**Laboratory Duplicates**

**Duplicate Sample MW 17C**

| | RPD | QC Limit |
|---|---|---|
| Total lead | 21 (b) | 20 |
| Dissolved Chromium | 200 (b) | 20 |
| Dissolved Lead | 188 (b) | 20 |
| Dissolved Magnesium | 22 5 (b) | 20 |

**ICP Serial Dilutions**

| | %D | QC Limit |
|---|---|---|
| Total Lead | 14 4 (b) | 10 |
| Dissolved calcium | 13 1 (b) | 10 |
| Dissolved magnesium | 18 9 (b) | 10 |

a/ MS = matrix spike RPD = relative percent difference %D = percent difference
ICP = inductively coupled plasma spectrograph

b/ Outside of QC limits

**Table A 10**

**Field Duplicate Results**
**Groundwater Sampling Results**
**Buckeye Reclamation Landfill**
**Belmont County, Ohio (ug/l) (a)**
**September 22 24, 1997**

| Compound | MW 11B | MW 60 | RPDs |
|---|---|---|---|
| **VOCs** | | | |
| Methylene Chloride | 4 J | 5 | 22 2% |
| Acetone | 4 J | 3 J | 28 6% |
| Carbon Disulfide | 2 J | 2 J | 0 0% |
| **Total Metals** | | | |
| Antimony | 2 7 J | 1 7 U | NC |
| Barium | 21 3 J | 15 6 J | 30 9% |
| Beryllium | 0 72 J | 0 3 U | NC |
| Cadmium | 0 54 J | 0 57 J | 5 4% |
| Calcium | 321000 | 319000 | 0 6% |
| Cobalt | 11 8 J | 16 3 J | 32 0% |
| Iron | 2020 | 2090 | 3 4% |
| Lead | 1 5 J | 3 2 J | 72 3% |
| Magnesium | 73800 | 71900 | 2 6% |
| Manganese | 897 | 893 | 0 4% |
| Nickel | 21 5 J | 24 7 J | 13 9% |
| Potassium | 5980 | 4770 J | 22 5% |
| Silver | 1 6 J | 1 2 J | 28 6% |
| Sodium | 74700 J | 72000 J | 3 7% |
| Thallium | 3 8 J | 3 7 J | 2 7% |
| Vanadium | 5 3 U | 5 3 U | 0 0% |
| Zinc | 14 7 J | 10 4 J | 34 3% |
| **Dissolved Metals** | | | |
| Barium | 9 2 J | 10 5 J | 13 2% |
| Calcium | 283000 J | 302000 J | 6 5% |
| Cobalt | 11 J | 18 J | 48 3% |
| Copper | 5 9 J | 18 7 J | 104 1% |
| Iron | 2800 | 1430 | 64 8% |
| Lead | 1 3 UJ | 1 3 J | NC |
| Magnesium | 65300 J | 68100 J | 4 2% |
| Manganese | 677 | 713 | 5 2% |
| Nickel | 14 5 J | 28 5 U | NC |
| Potassium | 4000 J | 3910 U | NC |
| Sodium | 66700 | 69100 | 3 5% |
| Thallium | 1 9 U | 1 7 J | NC |
| Vanadium | 5 3 U | 12 9 J | 83 5% |
| Zinc | 9 2 J | 16 2 J | 55 1% |
| **Other Analytical Parameters (mg/l)** | | | |
| Alkalinity | 402 | 406 | 1 0% |
| Ammonia nitrogen | 0 45 | 0 39 | 14 3% |
| Chemical oxygen demand | 5 U | 7 2 | NC |
| Chloride | 71 3 | 74 3 | 4 1% |
| pH (units) | 6 67 | 6 76 | 1 3% |
| Specific Conductance (uohm | 2060 | 2060 | 0 0% |
| Sulfate | 977 | 980 | 0 3% |
| Total dissolved solids | 1840 | 1870 | 1 6% |
| Turbidity (NTU) | 23 | 18 2 | 23 3% |

a/ U = undetected J = estimated concentration NC = not calculated RPD = relative percent difference